S. HRG. 99-621

IMPACT OF SPACE TECHNOLOGY ON HUMAN RESOURCES

HEARING

BEFORE THE

COMMITTEE ON LABOR AND HUMAN RESOURCES UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

ON

EXAMINATION ON THE IMPACT OF SPACE TECHNOLOGY ON HUMAN RESOURCES AND HOW RESEARCH DONE IN SPACE MAY IMPROVE THE LIVES OF INDIVIDUALS

DECEMBER 4, 1985

Printed for the use of the Committee on Labor and Human Resources

U.S. GOVERNMENT PRINTING OFFICE

59-304 O WASHINGTON : 1986

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

S541-46

COMMITTEE ON LABOR AND HUMAN RESOURCES

ORRIN G. HATCH, Utah, *Chairman*

ROBERT T. STAFFORD, Vermont
DAN QUAYLE, Indiana
DON NICKLES, Oklahoma
PAULA HAWKINS, Florida
STROM THURMOND, South Carolina
LOWELL P. WEICKER, JR., Connecticut
MALCOLM WALLOP, Wyoming
CHARLES E. GRASSLEY, Iowa

EDWARD M. KENNEDY, Massachusetts
CLAIBORNE PELL, Rhode Island
HOWARD M. METZENBAUM, Ohio
SPARK M. MATSUNAGA, Hawaii
CHRISTOPHER J. DODD, Connecticut
PAUL SIMON, Illinois
JOHN F. KERRY, Massachusetts

RONALD F. DOCKSAL, *Staff Director*
KATHRYN O'L. HIGGINS, *Minority Staff Director*

CONTENTS

STATEMENTS

WEDNESDAY, DECEMBER 4, 1985

	Page
Arrowsmith, George, Technet Systems design manager for Concepts for Independent Living, accompanied by Tom Cusworth, graduate; and Prof. Lester W. Cory, Southeastern Massachusetts University and winner of President's 1985 Volunteer Action Award	51
Prepared statement of Mr. Pierce	53
Prepared statement of Professor Cory	77
Grassley, Hon. Charles E., a U.S. Senator from the State of Iowa, prepared statement	6
Hawkins, Hon. Paula, a U.S. Senator from the State of Florida, prepared statement	7
Heckler, Hon. Margaret, Secretary of Health and Human Services	9
Prepared statement	14
Kirk, Robert L., president and chief executive officer, LTV Aerospace Corp., and chairman of the Executive Coalition	30
Prepared statement	33
Musgrave, Dr. F. Story, astronaut, National Aeronautics and Space Administration; and Dr. Royce Moser, coordinator, preventive medicine programs, University of Utah, and past commander, U.S. Air Force School of Aerospace Medicine and in charge of the Firefox Program	84
Prepared statement of Dr. Musgrave	86
Prepared statement of Dr. Moser	95
Yim, Susan, a quadraplegic who uses a computer to communicate; Thomas Murphy, a quadraplegic from the Maryland Rehabilitation Center; and Kathleen Cissna, a former police officer and recipient of an Eli Lilly defibrulator	43
Prepared statement of Mr. Murphy	47

ADDITIONAL MATERIAL

Questions and answers:	
Responses of Mr. Kirk to question submitted by Senator Hatch	41
Responses of Professor Cory to questions submitted by Senator Kerry	81

IMPACT OF SPACE TECHNOLOGY ON HUMAN RESOURCES

WEDNESDAY, DECEMBER 4, 1985

U.S. SENATE,
COMMITTEE ON LABOR AND HUMAN RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10:08 a.m., in room SD-430, Dirksen Senate Office Building, Senator Orrin Hatch (chairman) presiding.

Present: Senators Hatch, Thurmond, Kennedy, Grassley, Dodd, and Kerry.

The CHAIRMAN. We are very happy to welcome the Secretary of Health and Human Services here, our new Ambassador to Ireland, to this very important hearing on "The Impact of Space Technology on Human Resources."

Because Senator Thurmond needs to go to another hearing and chair another committee, we will defer and turn to him at this time for his opening remarks and then I will make mine, and Senator Kennedy will make his.

OPENING STATEMENT OF SENATOR THURMOND

Senator THURMOND. Thank you very much, Mr. Chairman.

Mr. Chairman, on November 28, 1983, President Reagan signed a proclamation which designated the years 1983 to 1992 as the National Decade of the Disabled. In the proclamation, the President encouraged rehabilitation programs and comprehensive services for disabled citizens so that they might enjoy more productive and independent lifestyles.

As a strong supporter of vocational rehabilitation programs, I am very committed to these goals.

Technologies which are available today can do much to improve the lives of disabled Americans. Technologies which will be available tomorrow will improve the lives of the disabled in ways which are unimaginable today. I have this optimism because the Space Program has demonstrated that incredible technological advances can be achieved within a relatively short period of time.

In 25 years, the Space Program has advanced from the earliest missions which orbited the Earth to the space construction projects of the Atlantis, the 23d successful space shuttle. During the span of just 10 years, our Nation began manned space missions and ended that decade by landing an American on the Moon. Such progress could only have been possible through continued advancements in aerospace technology.

We have already borrowed from this technology to improve health on Earth. The pump that drives the Jarvik-7 artificial heart has miniature circuits and compressors developed through aerospace research. These components have reduced the size of the pump from a 325-pound unit to the size of a camera bag. Nearly 20 percent of deaf persons may hear again with the use of an artificial ear implant developed with space-age materials.

Scientists at NASA have designed an exceptionally strong, lightweight wheelchair. It weighs approximately 25 pounds, which is one-half the weight of a conventional wheelchair. It can support a 200-pound person and is easily folded and stored.

These are just a few current examples of how space technology can enhance the lives of citizens with disabilities.

When leaders of the public and private sectors join resources to benefit disabled citizens, I believe there are no limits to what can be achieved during the Decade of the Disabled, and in the years beyond.

One of the major contributions of Secretary of Health and Human Services, Margaret Heckler, has been her success in this endeavor. Under her leadership, the Initiative on Technology and the Disabled was formed. It consists of NASA, HHS, and leaders of the aerospace industry.

Madam Secretary, I wholeheartedly commend you for this effort and for the outstanding service you have rendered to this Nation. I am sure that in the future you will continue this high level of competence, and I am very pleased that you are here today.

One of the organizations formed and funded by leaders of private industry is Concepts for Independent Living. Concepts is a prime example of the new spirit of volunteerism in America which has been so capably advocated by our President. This organization was a direct result of the Initiative on Technology and the Disabled. Its goals include the establishment of a nationwide computer system which will provide information to disabled citizens regarding Federal, State, local, and private resources available to them. This project will be operated by handicapped citizens.

I am extremely proud that the pilot project, which was the model for this endeavor, is located in Columbia, SC. Development for the South Carolina Handicapped Services Information System began in 1979. This system has now been operative for nearly 4 years. Disabled citizens can call a toll-free number and obtain information regarding thousands of available resources, such as recreational or rehabilitation facilities. In a recent month, nearly 500 referrals were made by SCHSIS to handicapped South Carolinians. The data base is constantly being enlarged. Recently, an equipment exchange program was included. This will allow individuals who need a wheelchair, for instance, to locate one through SCHSIS.

This South Carolina system has been extremely successful as a pioneer in this area. Accordingly, I was happy to assist in obtaining a grant for SCHSIS to develop a national resource information system for chronically ill children.

Mr. Chairman, thank you for scheduling this hearing. We are fortunate to have excellent spokesmen from the public and private sectors as witnesses today, and I appreciate the time they have taken to be here. Regrettably, scheduling conflicts prohibit my at-

tendance for the full hearing. However, I look forward to reviewing the testimony which will be presented.

Thank you very much, Mr. Chairman.

OPENING STATEMENT OF SENATOR HATCH

The CHAIRMAN. Thank you, Senator Thurmond. We are very proud to have you on this committee, and we appreciate the diligence with which you pursue your work on this committee.

I am also very proud to be sitting next to Senator Kennedy, who has been of great help to me on the committee. I would just point out that in 1961, President Kennedy told the Nation that before the end of the decade an American would set foot on the Moon. At that time, such an accomplishment seemed unimaginable. We watched with awe as the first space missions of pioneers Allan Shepherd and John Glenn took place, and our national dream began to unfold.

Today we reap the benefits of our Nation's successful Space Program from the early Mercury missions to the current shuttle program, and of course, Neil Armstrong's famous "One small step for man, one giant leap for mankind" continues to describe the evolving field of space technology.

During this quarter century in space, technologies have advanced at an amazing rate. We have gained enormous amounts of information and gleaned new knowledge about how one can function in space. We have been reminded that more often than not, to be realistic one must demand the impossible. This is a lesson and inspiration for us all, including the many disabled citizens on Earth. For those of us without disabilities, eating, walking into a room, talking to a friend or writing a sentence are second nature and subject to being taken for granted. However, for millions of disabled citizens, this routine can be excruciating. Yet, if space technology can assist us in controlling the hostile environment of space, our experience has taught us that his same technology can assist disabled citizens to overcome many of the heretofore "impossible" tasks which they face daily.

The purpose of this hearing is to discuss how present and future applications of space age technology can improve the quality of life for disabled citizens.

Today we will also hear about new technology which can revolutionize the health care field.

The medical field, as we all know, has dramatically changed, and the entire field of diagnostic medicine has been affected. New computer technologies have changed the way we diagnose and the way we treat a number of diseases. Indeed the future holds even more promise.

New pharmaceutical research, which holds the potential for purer drugs, is being conducted in space. Osteoporosis, the demineralization of bones, is one of the major problems preventing long stays in space. And of course, this disorder affects millions of elderly women. Hopefully, the research done in space will improve our ability to prevent this disabling disorder.

Space technology is also being applied to better control blood pressure and diabetes. The potential that space technology provides

for improving our health is staggering. This is one area in which the Government is likely to receive far greater dividends on its investment than anticipated.

I am especially pleased to chair this hearing and to alert the public attention to the most recent scientific advancements. However, there is, in my opinion, no greater advocate for improving the lives of disabled citizens through the use of space technology and otherwise than our own U.S. Secretary of Health and Human Services, Margaret Heckler. Inspired by President Reagan's proclamation that 1983 through 1992 is the Decade of the Disabled Persons, Secretary Heckler launched the National Initiative on Technology and the Disabled. Under her leadership, a unique coalition consisting of the Department of Health and Human Services, the Department of Defense, the National Aeronautics and Space Administration, and private industry has been forged to focus talent, experience, and resources to find solutions to the obstacles encountered by millions of disabled Americans.

The contributions of Secretary Heckler in this effort are characteristic of the outstanding service that she has rendered to our Nation and will render in the future.

Madam Secretary, it is indeed an honor to have you here today. I want to personally express my appreciation for your kindness in explaining the initiative to me on previous occasions. I am a very enthusiastic supporter of the work you are doing. This hearing will highlight your efforts to reapply technology to enhance the lives of our disabled citizens.

In addition to Secretary Heckler, we will hear from leaders in both the private and public sectors, all of whom are committed to the Heckler initiative. Some of them directly provide services to our disabled citizens. I particularly look forward to listening to the testimony of three individuals who are beneficiaries of breakthroughs in technologies in their areas. I am talking about scientific advances which are improving the access to and the quality of health care for all Americans.

Following the hearing at 1:30, all of you are invited to attend a symposium on technology and the disabled in room 628 of the Dirksen Building. There will be a display of some of these innovative devices and an informative film, "Inspire '85," will be shown at regular intervals.

I look forward to hearing the testimony of today's witnesses. The Honorable Margaret Heckler, Secretary of Health and Human Services; Mr. Robert Kirk, Chief Executive Officer of LTV Aerospace Corporation; Ms. Susan Yim, MC. Thomas Murphy, and Ms. Kathleen Cissna, all individuals living with this technology. I am also pleased to welcome Mr. George Arrowsmith, the tech-net system design manager for Concepts for Independent Living. This is a wonderful deed, and I personally want to again say, thank you, Madam Secretary, and on behalf of all Americans express thanks for your efforts to enrich our lives.

Let us turn to Senator Kennedy at this time.

OPENING STATEMENT OF SENATOR KENNEDY

Senator KENNEDY. Thank you very much, Mr. Chairman.

I want to join in commending you for holding this extremely important and hopeful meeting of our Human Resources Committee and welcome back to our committee the distinguished Secretary of HHS, Margaret Heckler, who has served with distinction in that position and has now been given new opportunities for service as our country's representative to Ireland. She is an old friend to this committee and to myself, having served with great distinction in the Congress, representing our State. And I think it is rather typical of Margaret Heckler that she took this initiative in HHS to try and find ways of applying the new technologies developed in the aerospace industry, primarily, and see its application in terms of reducing the barriers to those who, as my son Teddy mentions, are the physically challenged in our society.

What we are really talking about today is putting a human face on high technology; that is what we are talking about here. And I think at a time when there is a great deal of criticism and skepticism—some, appropriately so, but some, unwarranted—about how the Government and the private sector can work together.

We are hearing this morning about one of the very important successes—and not just what we are going to hear today, but the potential in terms of the future is really unlimited. I think this is an extremely hopeful day. It is really the private and the public sector coming together in the best of our very proud tradition.

I would also just like to mention, Mr. Chairman, as we hear about the new innovations and new applications of technology, we also have to concern ourselves about the costs of these technologies and who is going to be able to afford them.

I am always extremely moved when I have the opportunity to attend a handicapped skiers' race, which my son involves himself in, to see so many of the young skiers who have lost a limb still going up to receive their award on crutches because they cannot afford the artificial limbs. And as we hear about these new breakthroughs in terms of technology that can open up in an extremely important and significant way for new opportunities, new hopes, new horizons, we also have to be mindful about what kind of a commitment we as a society are going to make in terms of making these new kinds of technologies available to people at prices that people can afford to pay.

Madam Secretary, there is a movie and a book that talk about the right stuff. That was a term that was used for those who challenged space and served this country well. And I think you are representing the right stuff here today in the applications of new technologies to try and reduce the barriers for the physically challenged in our society, and I welcome you here.

Secretary HECKLER. Thank you, Senator.

The CHAIRMAN. Thank you, Senator Kennedy.

Senator GRASSLEY. Mr. Chairman, I will not be able to ask any questions at this point. I might have some in writing, and I do have a statement which I would ask be placed in the record.

The CHAIRMAN. Without objection, so ordered.

Senator GRASSLEY. I do want to welcome Secretary Heckler here, and wish her luck in her new job.

Secretary HECKLER. Thank you, Senator.

The CHAIRMAN. Thank you, Senator Grassley.

[The prepared statement of Senator Grassley follows:]

PREPARED STATEMENT OF SENATOR GRASSLEY

Senator GRASSLEY. Mr. Chairman, you are to be commended for holding this hearing to focus on technological developments that can be of benefit to physically challenged members of our society. I would also like to commend Secretary Heckler for her visionary leadership in establishing the National Initiative on Technology and the Disabled. I join Secretary Heckler in hoping that through the cooperation of executives in Government and in the aerospace industry both will be challenged to creatively apply advanced technology to enabling the physically challenged to lead more productive and rewarding lives.

Traditionally, we tend to think in terms of pocket calculators, microwave ovens, digital watches, and the like when we list practical items that have emerged from space technology. These products have one thing in common: they have improved the quality of our lives and increased our productivity in the workforce.

Evidently, high technology holds equal or greater promise to improve the lives of the physically challenged, but that promise remains to some extent unfulfilled. The goal of the National Initiative on Technology and the Disabled is to close the gap between the development of technology and its application to the needs of people with disabling conditions.

Mr. Chairman, 1983–92 has been designated by the President as the decade of the disabled. The goals of the decade of the disabled are to enhance the quality of life and expand the productive capacity in the work environment of the physically challenged. The National Initiative on Technology and the Disabled is consistent with the goals of the decade of the disabled and will, I hope, help to achieve its goals.

I look forward to learing more about the program from today's witnesses.

The CHAIRMAN. We will now receive for the record a statement by Senator Hawkins.

[The prepared statement of Senator Hawkins follows:]

Paula Hawkins

STATEMENT OF SENATOR PAULA HAWKINS BEFORE THE SENATE LABOR AND HUMAN RESOURCES COMMITTEE ON "THE IMPACT OF SPACE TECHNOLOGY ON HUMAN RESOURCES", DECEMBER 4, 1985

For more than twenty years, this nation has devoted tremendous resources to the development of space programs. Technological growth has been phenomenal. Miniaturization, development of new materials, and the collection of information about problems related to movement, communication and life-support in space have provided us with a tremendous technological potential.

This technological potential has already begun to work to improve the quality of life for disabled individuals. Through cooperation between the Federal government and U.S. companies engaged in aerospace and defense activities, we have seen the development of new products that allow disabled individuals to become more productive Americans.

Medical devices that once required a recipient to carry a heavy power-pack now operate from pocket-sized power sources. Strong, light-weight materials developed for the space program have been used to make light-weight, but strong, wheel chairs. Communications systems used for space travel have contributed to

the development of systems that allow those unable to speak, the ability to communicate with other individuals.

The aerospace and defense industries have made significant contributions. Their employees have volunteered for research and engineering teams that work to develop devices to solve specific disability problems. They have also contributed to the development of a computer-based information system designed to inform disabled persons about resources available to them.

I fully support these efforts. I commend the Department of Health and Human Services for initiating cooperation in this vital effort between agencies and the aerospace and defense industries.

The CHAIRMAN. Senator Kerry.

Senator KERRY. I just have a very brief comment, and thank you very much, Mr. Chairman.

I am delighted to welcome Secretary Heckler here and join with my colleague who, unlike myself, did work here jointly with Secretary Heckler for so long; but I have worked from the outside, in the State, and I am delighted not only to welcome you here, but as a member of the Foreign Relations Committee, to say that we certainly look forward to seeing you there, and I look forward to voting for you and seeing you go up on your way to Ireland.

I thank you also, I think, on behalf of a lot of us in Massachusetts, for the work you have done as Secretary under some difficult circumstances, I think. I know you have fought hard to maintain your commitment to the compassion and the goals that you set as a Congressperson, and I am delighted that you were able to do that.

Let me say that with respect to this particular hearing, I would like to commend Secretary Heckler for her aggressive efforts in launching the National Initiative on Technology and the Disabled, and simply say that I think it is very important, obviously, that we move in this direction because there is so much that can be done. And I am delighted to be able to welcome Prof. Lester Cory, who has done so much at Southeastern Massachusetts University with his crew, to help to prove what can be done in this area, and he has done an exceptional job.

Needless to say, however, I do think it is important that this committee and all of us who are members of it, while we do take the time to look to the benefits that can be provided to, as Senator Kennedy said, the "physically challenged," that we not lose sight nor pretend that this kind of high technology is going to provide a panacea for some very fundamental needs that are still unmet.

As I travel, certainly in Massachusetts, and talk to the physically handicapped, there are four critical needs that continually leap out, which are: Lack of housing; lack of jobs and skilled training; lack of transportation; and lack of resources to pay for necessary medical care.

And, while I absolutely welcome this, and this is terribly important, I just want to make certain that we do not lose sight of the practical needs that will not be met by high technology but by simple technology and by some of the other things that we have to do.

Thank you very much, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Kerry.

Madam Secretary, we look forward to your testimony at this time, and again, we want to thank you for the leadership you have provided in this area. I think handicapped people all over America are going to reap the benefits of your leadership for many years to come. I agree with the comments that have been made here today. There is much that needs to be done with and for the handicapped today and in the future. This initiative is a prime example of what we can accomplish through cooperative efforts and innovative ideas and I might add, at no real cost to the taxpayers.

So let us turn the time to you.

STATEMENT OF HON. MARGARET HECKLER, SECRETARY OF HEALTH AND HUMAN SERVICES

Secretary HECKLER. Thank you, Mr. Chairman and members of the committee.

I want to thank you so much for your gracious comments and your leadership, Mr. Chairman, on this issue and on so many other issues on which we have worked together.

To Senator Kennedy, I want to say I know of his deep commitment and how personally this issue has touched his life, and I know of his leadership in this field.

I am also delighted to appear before our new Senator from Massachusetts, Senator Kerry, whom I respect and whose leadership has gone back for many years, and who I know understands the problems of the disabled, the problems of the handicapped from at least the Vietnam experience and then, subsequent to that, his senatorial experience.

I am also consoled to know that I will have your vote on the Foreign Relations Committee. That is the only one that I have so far, and it is a good beginning. [Laughter.]

And for Senator Thurmond's comments, I certainly am very, very grateful.

Mr. Chairman, I consider the issue that this committee will consider today very important. I have submitted a statement for the record. I would like to summarize the contents of that statement very briefly.

The CHAIRMAN. Without objection, we will put all statements in the record. Other than you, we will limit all witnesses to 5 minutes. But since you are the leader of this initiative we would like to give you whatever time you need.

Secretary HECKLER. Thank you, Mr. Chairman. I shall attempt to be as brief as possible.

The fact is that our Department, the Department of Health and Human Services, which is the people's Department of this Government, already directly funds programs for the disabled in certain ways, and in fact, our Disability Program under the Social Security Administration will spend $20 billion this year for the fundamental financial needs of the disabled who qualify for that program. We will also spend $6.3 billion this year for the Supplemental Security Program for the Blind and Disabled. But we all know that much more remains to be done.

President Reagan declared this, in confidence with other leaders of other countries, to be the Decade of the Disabled, under a proclamation which was issued by the United Nations, and every country in the world, in one way or the other, is honoring the disabled in a special way.

I pondered how the Decade of the Disabled could be translated from rhetoric into reality, and found within our own Department, citing the grant which Senator Thurmond referred to earlier, the grant to the State of South Carolina became the genesis, the starting point, for this new initiative, because in the State of South Carolina, the Department of Health and Human Services funded for the first time an attempt to create an informational network for the disabled within that State. The results were astonishing. The maze of offices and support services which were available to the disabled community were refined to the point where it was not a maze that was frustrating and anxiety producing but was a process which had the value of simplicity and accuracy and immediacy, making all of the services available to the disabled totally accessible.

In HHS, in a period of severe budget crunch and deficit concerns, I wondered how we could replicate the experience of South Carolina across the country. And obviously, we could not seek another large appropriation—and indeed, it would have been large—but we did have resources utilizing the philosophy of President Reagan and this administration, the resources of the private sector, because this is truly a new season of partnership between Government and industry, Government and private citizens.

The level of volunteerism in the country is staggering and mounting constantly, and I pondered whether or not we could enlist very unique volunteers in the effort to bring high technology to the handicapped.

The volunteers I wished to enlist were those with the unique skills who had, through their sophistication in the development of spacecraft and weapons systems, the ability to translate technological gains into meeting the problems of disabled citizens.

The concepts which this initiative embraces are basically two. The first concept involves the dissemination of information through a network, through an informational network in each State.

The funding for the program will be volunteered as well by the private sector. All of the funding and the expertise for the program, all of these things will be the result of those companies and

their engineering talents which step forward and agree to fund the system.

A prototype has been established in the State of Washington under Concepts for Independent Living, which was an organization in existence for several years, dealing with the problems of the disabled. The two facets of this program involve the creation of a technological net in each State. The prototype system has been set up in Washington, and there, the kinks, we believe, have been removed, and the system is operational and functional. The technological net actually relates to a simple 800 number, a phone number which is linked to a computer operated by a handicapped person and which indeed will provide the information which any disabled person in the State requires on services, on funding, on support systems.

It is very difficult for some of us who are blessed not to have the limitations of the disabled to understand at times how excruciating it is simply to, if one is in a wheelchair, to find a dentist who will serve the patient from the wheelchair and not from a dental chair. Most of us do not worry about that problem, but there are a number of dentists who find it difficult and some who refuse to serve handicapped people in wheelchairs, because it is too difficult for them.

This new system, the informational network, will provide detailed information through a computerized system of both the availability of resources not only in Government but in the private sector, and the availability of professional services.

Already there are very remarkable stories which will be shared this morning with the committee from the State of Washington on the use and the real success of creating the technological net. The prototype exists. We want that prototype to be replicated across the country in every State.

But I underscore one point. The prototype exists because there has been private funding. This is a voluntary effort which again has relied for its expertise and skill as well as its funding on the generosity of the private sector, especially the aerospace and defense industries.

The second phase of the program involves the same type of practical response to human needs that you discussed, Senator Kerry, in talking about the day-to-day living needs of the disabled. Through the creation of technological teams which will support the TechNet concept, we have encouraged the aerospace industries to allow their engineers on company time to donate time to addressing 1 on 1 the needs of specific problems, specifically for severely disabled citizens.

Now, we are stressing the target of the severely disabled, because above all, these are the people who truly could fall between the cracks. There have been volunteer efforts already undertaken by the Westinghouse Co., for example, in Baltimore, where in response to the need of a citizen who had been stricken by a stroke, who was totally immobilized, the engineers from Westinghouse in addressing his problem—the needs of a very, very bright person who could not communicate in any way—went back to their laboratory and devised a system whereby, through a series of blinks, this man could learn to communicate on a computer. The circuit which

was linked to the computer was attached to the rim of his glasses. He was totally immobilized, could not even move his forehead; but by learning a series of blinks, he was able to send messages and then to speak again. And I am told the first message that he sent was, "Oh, boy!" And I can understand why he reacted that way.

These technological teams, frankly, the Government could never fund. We, in even our most lush financial period, with our most generous attitude toward helping the disabled, could not afford the time and the expense of providing the sophisticated engineering skills that hopefully will be encouraged and will be utilized in this program on a voluntary basis.

These are the two factors of the concept—the technological net, the tech teams The concept would have been a dream were it not for the responsiveness of one leader in the aerospace industry, Mr. Robert Kirk, whom you will hear from later, who was willing to take on the fundraising responsibility and happened to be in a very critical role as chairman of the Aerospace Industries of America. Now, his leadership provided the impetus for other companies to make a commitment, and this commitment provides the funding for the system as well as the commitment of engineering skills across the country from one company to severely disabled citizens within their purview to deal with their severe problems.

The funding will be provided by the private sector, and sophisticated devices in certain cases will be the result of the innovative effort.

There will be unique devices, orphan devices, and this Congress—and I was a part of that measure, the development of the orphan drug law, and I know that Senator Kennedy and Senator Hatch played very critical roles; Senator Hatch is one of the godfathers of the law—in fact, I believe that we will now have an orphan device system which will be uniquely trained and uniquely focused on the specific deficits of individual citizens, and these devices will not serve the needs of every disabled citizen, but they will compensate for the losses and the severe limitations of those who are the most vulnerable among us.

So this complies with the initiative which has been announced. Senator Hatch is very aware of the fact that we have an advisory committee on which he will serve, and hopefully, you will serve, Senator Kennedy——

The CHAIRMAN. Are you asking him now, because we might be able to get a commitment out of him?

Senator KENNEDY. Is that an offer?

The CHAIRMAN. That is an order.

Secretary HECKLER. Yes, it is an order—and an offer, as well—and Senator Kerry, as well.

The fact of the matter is, this committee is encouraged to take part in the advisory committee. But I would simply like to say that this is an issue whose time has come; that the same technology that could lift a spacecraft can lift man's dreams and can change our lives here on Earth.

For the disabled, the hostile environment is not space; it is Mother Earth, and their needs are very profound. This is a unique response to those needs, and I hope in my new role to carry it to an international forum and to make it a worldwide movement. But we

have begun, and we have begun now, and we have begun today. And I would enlist the support of this committee in a very active way in seeing to it that these goals are achieved.

We need to have the Governors' support in every single State. We must put together the data base for every State to make the TechNet operational. And in fact I believe, as Senator Kennedy so well said it today, that it is time to applaud the industrial leaders, the leaders from the aerospace industries. And I am proud of the fact that Brainerd Holmes from Raytheon Corp., in Massachusetts, is one of our Executive Coalition members—but the leaders from United Technologies, the Boeing Co., Mal Stamper, and a number of others are stepping forward, doing something that does not affect their balance sheet and is not in their profit-and-loss statement, but truly can uniquely affect the lives of the disabled.

It is critically important that the Congress continue to support this initiative and that in every single way, we engage not only aerospace companies and defense companies, but every high-technology company, to participate, to create this army of engineers who can make a difference.

Now, we cannot make the lame walk or the deaf hear or the blind see, as the Lord can do, but we can make advances toward achieving those goals in our own human way, and this step and this initiative is designed to do that.

I think it is quite remarkable because of the willingness of industry to be supportive, and it offers a great potential for mankind.

Thank you, Mr. Chairman.

[The prepared statement of Secretary Heckler follows:]

THE SECRETARY OF HEALTH AND HUMAN SERVICES
WASHINGTON, D.C. 20201

Statement of

MARGARET M. HECKLER

Secretary of Health and Human Services

before the

Senate Committee on Labor and Human Resources

December 4, 1985

GOOD MORNING, MR. CHAIRMAN [SENATOR HATCH (R-UT)]. I WOULD LIKE TO THANK YOU AND SENATOR KENNEDY (D-MA) FOR INVITING ME TO ADDRESS THIS COMMITTEE ABOUT AN EXCITING NEW INITIATIVE UNDERWAY AT THE DEPARTMENT OF HEALTH AND HUMAN SERVICES. THIS PROGRAM, THE NATIONAL INITIATIVE ON TECHNOLOGY AND THE DISABLED, IS A PARTNERSHIP BETWEEN THE GOVERNMENT AND AMERICA'S AEROSPACE AND HIGH-TECH COMMUNITIES TO DESIGN, DEVELOP, AND FOSTER NEW APPLICATIONS OF TECHNOLOGY FOR THE MORE THAN 35 MILLION AMERICANS WHO CONFRONT PHYSICAL, DEVELOPMENTAL, MENTAL AND/OR SENSORY DISABILITIES.

THE GENESIS OF OUR INITIATIVE CAME IN 1983 WHEN PRESIDENT REAGAN DESIGNATED THE YEARS 1983-1992 AS THE DECADE OF THE DISABLED. HEARING THE PRESIDENT'S "CALL TO ARMS", AND WITH THE ASSISTANCE OF THE DEFENSE DEPARTMENT AND NASA, WE ENLISTED THE SUPPORT OF LEADING AEROSPACE AND HIGH TECH COMPANIES TO CREATE A MECHANISM THROUGH WHICH NEW APPLICATIONS OF TECHNOLOGY COULD BE DESIGNED AND DEVELOPED TO MEET THE NEEDS OF THE DISABLED.

WE KNEW THAT THE AEROSPACE AND DEFENSE INDUSTRY WAS IN A UNIQUE POSITION TO MAKE A REAL DIFFERENCE TO THE DISABLED BECAUSE AMERICA'S SPACE PROGRAM HAS YIELDED AMAZING NEW INSIGHTS INTO THE PROBLEMS OF MOVEMENT, TRANSPORTATION, COMMUNICATION, AND LIFE-SUPPORT IN A HOSTILE ENVIRONMENT.

We realized that the same technology used to reach the stars can be applied to conquer the physical constraints encountered by people with disabilities here on earth.

In fact, this technology has already produced remarkable new devices for the disabled. For example, at the Department of Health and Human Services we recently approved a remarkable new device, an implantable defibrillator, developed by Cardiac Pacemakers, which uses microminiaturized components tested in outer space, and command and memory systems designed for the space program. The implantable defibrillator will assist over 20,000 Americans who suffer from ventricular fibrillation, and would not exist without aerospace technology.

Also, America's space technology was necessary for the development of a cochlear implant to assist individuals with hearing disabilities.

This device has changed life for Christopher Ising, the first recipient of this artificial ear in Kentucky. Disabled by spinal meningitis as a teenager, he was unable to hear with a conventional hearing aid. However, after the cochlear ear device was implanted he could hear some of the sounds around him, like dial tones, and bread popping up from his toaster. In fact, he was able to find a job, and feel a new heightened sense of freedom, independence, and dignity.

ANOTHER EXAMPLE IS SUSAN YIM, A GRADUATE STUDENT IN BIOLOGY, WHO SUFFERED A BRAIN STEM STROKE AT AGE 24. EXCEPT FOR SLIGHT THUMB MOVEMENT, THE PARALYZING NATURE OF THIS STROKE LEFT SUSAN A QUADRIPLEGIC, UNABLE TO COMMUNICATE. BUT, SUSAN WAS NOT MENTALLY IMPAIRED. FOR MONTHS, SUSAN WAS LITERALLY TRAPPED INSIDE AN UNRESPONSIVE SHELL, DEPENDENT ON FAMILY AND FRIENDS, WHILE DOCTORS AND THERAPISTS TRIED TO FIND A WAY TO ALLOW HER TO COMMUNICATE.

THEN, AN ENGINEER DEVELOPED A COMPUTER DEVICE TO TRANSLATE MORSE CODE, AND TAUGHT SUSAN TO INPUT INFORMATION INTO THE MACHINE USING SENSITIVE RODS, OPERATED BY HER THUMBS. NOW SUSAN IS ABLE TO USE HER MIND TO CONTINUE HER STUDIES AND LIVE A MORE FULFILLING EXISTENCE.

THESE ARE JUST TWO EXAMPLES OF TECHNOLOGICAL MIRACLES. THIS INITIATIVE GIVES US THE ABILITY TO "GO FORTH AND MULTIPLY" -- TO ... ORGANIZE AND EXPAND THESE EFFORTS NATIONWIDE. THE AEROSPACE ... INDUSTRY HAS JOINED HANDS WITH US TO OFFER FREEDOM AND INDEPENDENCE THAT GOVERNMENT ALONE COULD NEVER PROVIDE.

IN FACT, THE PRIVATE SECTOR, WITH THE ASSISTANCE OF AN EXECUTIVE COALITION OF CORPORATE EXECUTIVES, LED BY ROBERT KIRK, PRESIDENT AND CHIEF EXECUTIVE OFFICER OF LTV, IS DEVELOPING TWO INNOVATIVE PROJECTS.

FIRST, A NATIONAL INFORMATION NETWORK, CALLED "TECH NET", WILL COLLECT AND DISSEMINATE INFORMATION ON PRODUCTS, DEVICES, AND SERVICES THAT ARE AVAILABLE TO INDIVIDUALS WITH DISABILITIES, PHYSICIANS, RESEARCHERS, ENGINEERS, AND PRIVATE ORGANIZATIONS.

A PROTO-TYPE OF THE "TECH-NET" SYSTEM HAS BEEN DEVELOPED BY CONCEPTS FOR INDEPENDENT LIVING, A 501(C)(3) NON-PROFIT ORGANIZATION IN THE STATE OF WASHINGTON, USING THE RESULTS OF A MODEL DEVELOPED EARLIER UNDER AN HHS GRANT IN SOUTH CAROLINA. "TECH-NET" IS ALREADY ON LINE IN THE STATE OF WASHINGTON. THIS NETWORK WILL BE EXPANDED TO A FOUR STATE DEMONSTRATION GRID, WITH THE EVENTUAL INCLUSION OF ALL FIFTY STATES BY THE END OF PRESIDENT REAGAN'S ADMINISTRATION.

SECOND, THE PRIVATE SECTOR IS DEVELOPING A "TECH TEAM" PROGRAM. LOCAL TEAMS OF RESEARCHERS, SCIENTISTS, ENGINEERS, PHYSICIANS, AND OTHER SKILLED PROFESSIONALS WILL BE ORGANIZED TO ... APPLY THEIR SKILLS AND TECHNICAL KNOWLEDGE TO AID AMERICANS WITH.. DISABILITIES MASTER OBSTACLES ENCOUNTERED IN DAILY LIVING.

A PROTO-TYPE OF THIS APPROACH HAS BEEN DEVELOPED BY THE VOLUNTEERS FOR MEDICAL ENGINEERING, INC. (VME), A NON-PROFIT ORGANIZATION OPERATING IN MARYLAND. VME RESEARCHERS AND ENGINEERS HAVE DEVELOPED DEVICES AND TRAINING PROGRAMS TO ADDRESS PARTICULAR DISABILITY PROBLEMS ENCOUNTERED BY CLIENTS WHO SEEK THEIR HELP.

THIS APPROACH IS ADVANTAGEOUS BECAUSE "TECH TEAMS" WILL HELP ADDRESS DISABILITIES INDIVIDUALLY. EQUALLY ADVANTAGEOUS, AMERICANS WITH DISABILITIES WILL BE INVOLVED IN THE DESIGN AND DEVELOPMENT OF THE PRODUCTS THEY WILL USE. LINKED TOGETHER BY THE "TECH-NET" SYSTEM, THE LOCAL "TECH TEAMS" WILL BE ABLE TO FOCUS NEW APPLICATIONS OF TECHNOLOGY ON THE PARTICULAR NEEDS OF EACH PERSON WITH A DISABILITY.

THE POTENTIAL OF THIS PROGRAM HAS ALREADY BEEN DEMONSTRATED. FOR INSTANCE, DAVID WARD, A QUADRIPLEGIC, HAS ALREADY BENEFITED FROM THIS "TECH TEAM" APPROACH. HE IS NOW ABLE TO MOVE HIS FINGERS AGAIN THANKS TO A HAND SPLINT CREATED ESPECIALLY FOR HIM BY A WESTINGHOUSE SCIENTIST PARTICIPATING IN THE VME PROGRAM. DAVID'S HAND HAS BEEN TRANSFORMED FROM A USELESS LIMB WITH NO MOBILITY, INTO A USEFUL TOOL WITH CONSIDERABLE MOVEMENT. THIS REPRESENTS FOR HIM A WHOLE NEW WORLD OF FREEDOM AND DIGNITY.

PUBLIC/PRIVATE SECTOR INITIATIVES ARE UNIQUELY SUITED FOR THIS PROBLEM AREA. THE PRIVATE SECTOR CAN RE-FOCUS ITS PRODUCT DEVELOPMENT AND MARKETING STRATEGIES TO ADDRESS THIS SITUATION. IT CAN ALSO PERSONALIZE; IT CAN MATCH GENIUS, SKILL, AND CARING WITH INDIVIDUAL NEEDS. COSTLY GOVERNMENT PROGRAMS ENCOURAGE STANDARD, UNIFORM APPROACHES TO SUBTLE HUMAN PROBLEMS. GOOD INTENTIONS GET LOST IN A MAZE OF RED TAPE.

The CHAIRMAN. Thank you, Madam Secretary. I am impressed by your eloquent testimony, and we will submit your written statement in the hearing record as well.

Much of the technology for the disabled that we hear about today is very expensive. Could you tell us what resources are available to help make these advances available and what alternatives are there as well?

Secretary HECKLER. Of course, there are programs which fund technology that is medically necessary under those who are eligible for the programs. In this initiative, we are looking at the creation of technology through volunteer efforts. But I have to say that while we are calling upon the sophisticated skills and the engineering talents of the aerospace industry in this case at the outset, we look upon the needs of the disabled to embrace not only the sophisticated needs, but simple needs, in which engineers can make a difference; for example, in terms of re-engineering some of the work space, designing new doorframes, changing the life conditions in very simple, direct ways, that the engineers who are tinkerers at heart can change through the use of their skills.

So the interface that we envision will go from meeting the simple needs of disabled citizens in their own homes, the severely disabled, to the more sophisticated, through the creation of these devices. The funding will be provided through private funds, and this is the commitment that has been made—so far, over $1 million has been raised, and we are looking toward a much larger fundraising effort, and we also expect to see private foundations enter the field and supply some of the funds.

I do not think it is possible today to estimate how much money will ultimately be utilized; I think it will far exceed anything that has been discussed.

The CHAIRMAN. We hope private foundations and other industries will get involved as well and help to raise the private sector capital that is essential here.

Where did the initiative for the Executive Coalition come from; could you tell us that?

Secretary HECKLER. The initiative for the Executive Coalition was a device to encourage through leadership the involvement of the whole industry. I particularly wanted through personal appeals to reach some of the leaders in the aerospace industry as the initiators of the project and asked chairmen of different companies to participate personally, and these individuals comprise the Executive Coalition.

The CHAIRMAN. Madam Secretary, what is the FDA approval process for some of these devices that we will be hearing about today as well as others?

Secretary HECKLER. Well, the FDA approval process for devices will not affect the special, unique orphan devices that will be created through the initiative for specific citizens and their individual needs. The FDA process will actually apply to those devices which will be manufactured commercially for mass consumption or larger consumption, and it will simply follow the usual procedures at FDA.

The CHAIRMAN. What are the incentives for corporations or other potential donors to get involved on the Executive Coalition, if you can tell us that?

Secretary HECKLER. I have reached out to the leadership of the aerospace industries at the outset and simply offered them the incentive of making a difference in people's lives, in the lives of the disabled and especially the severely disabled.

Frankly, the industry that is involved in spacecraft development, weapons system development—this type of industry has the unique skills to create unique devices. They are used to creating prototypes to systems engineering and to environmental controls, and it is that type of sophisticated background that offers their engineers the chance and the opportunity to transfer technology to meeting human needs.

The incentive also exists from the experience of, for example, the Boeing Co., which has involved itself in meeting the needs of disabled citizens and found that there was a great benefit to Boeing through the increased morale of engineers who would, on the one hand, be working on the drawing boards on their own projects, and then later in the day, dealing with the needs of a disabled person who became totally dependent on their skills and who gave them a sense of purpose and realization of their own value to society in a way that their professional careers did not.

So there is an incentive in terms of employee morale and the translation of skills into human values that is an intangible but real incentive for the companies.

I think that one has to say as well that the leadership, the industrial giants who have come forward in this program, do care, and are anxious to make a contribution to this society. And this is a side of industry that is not often revealed or perhaps understood, but I found it very real and vibrant, and in fact, the backbone of the whole initiative.

The CHAIRMAN. Well, thank you, Madam Secretary. I again want to commend you for this initiative.

Let us turn to Senator Kennedy.

Senator KENNEDY. Thank you very much.

I might just mention, since you talk about Boeing, that they have through their materials made a very extraordinary contribution in the area of artificial limbs. I know now that the materials which they have developed are part of the composite that are in the limb which my son wears, and they have been very, very active in that area because of their working with various materials.

I mentioned before the cost of the leg. Teddy's leg cost $3,000 when he first got it, but it now is up, in terms of latest technology, to $10,000—and for the most part, lasts about a year. And as I have pointed out on other occasions, Members of Congress have the best health insurance program that there is, but there is no coverage for that. And no family that has less coverage is able to afford those kinds of technologies.

So I am glad that the chairman in his opening statement talked about the cost and availability. I think that is certainly not the focus of this particular hearing, but it certainly has to be something, as we move through this consideration, that we have to be mindful of.

Secretary HECKLER. Senator, if I might just interject, one of the unusual developments, and in fact, most active purposes and uses of the technological net in the State of Washington has been the use of equipment, for example, wheelchairs. A child who has an injury or a disability will actually outgrow his wheelchair or hers as they grow, just as they outgrow their shoes and all other clothes. Through the data base that has been created in Washington, there is a vehicle for passing on wheelchairs to another child with that same disability. I do not know that such a thing will be available in terms of artificial limbs, but for the first time, through the computer system, we are going to be able to know what unique devices are available, and those who wish to sell them to someone else, used equipment will become available, and I know some will be donated, and there will be that sharing of even the most personal devices.

Now, this does not completely address the issue you have raised, but it does create a new way of dealing with cost and utilizing devices far more productively.

Senator KENNEDY. Well, that is an innovative program and certainly ought to be considered by other States as well in addressing some of the particular needs.

I do not know what you might be able to add—and maybe this would be more appropriate for Mr. Kirk—but as to ways that you think this whole process can be maximized. I think you have spoken very eloquently about various initiatives that have been developed by the whole Executive Coalition. But are there other ways that you think that we in the Congress can help and assist in terms of maximizing these opportunities as well? Clearly, this is a new initiative. I share the feeling that you have to be able to crawl before you walk, and walk before you run. But nonetheless, I do think it offers enormously significant potential. Reviewing the testimony for today, it is absolutely mind boggling, whether we are talking about the functioning and workings of the brain or whether we are talking about the various impulses that are possible to transmit in terms of utilization of various limbs, the whole range of different new technologies which I know that we are going to hear about today.

But I am just wondering if there is anything that you would suggest we might think about in terms of trying to see this whole process move further forward?

Secretary HECKLER. Yes, Senator; there is. I feel it is very important to have the involvement and participation of a vast array of industries. Certainly, the leadership has come from the aerospace industry at the outset. There is no reason why high-technology firms of all descriptions, meeting all needs, cannot offer the same type of engineering support and participate to the best of their ability, to create this army of engineers. The technology teams come from those with the technological background. If all of the companies in this field are encouraged to participate, I feel we can make breakthroughs that will be virtually unlimited. I think this is very important, and I think every Member of Congress should be involved in enlisting companies in this important venture.

Beyond that, I think it is terribly important that the Governors of the individual States take this on as a priority. Right now, as a result of the leadership of Concepts for Independent Living, we

have a prototype for the technological net. This prototype can be replicated in every State. The delay will come not in the installation of the system, but in the development of the data base. And if Governors—and I am going to personally solicit their involvement—but if the Governors will begin by creating a priority, that is, a priority for the disabled, through the implementation of this plan, and then associate the plan with the leadership within their own State, begin the gathering of the information for the data base, the technology can be put in place in a relatively short period of time.

Now, I feel very strongly that the only delay that can possibly occur will be the inertia of government leaders who are not going to be involved enough, to see to it that this priority is actually achieved. And frankly, I certainly would solicit your leadership in this regard and that of every other member of the committee, because it is going to be critical to making a difference.

I will say that I think it is not impractical to think that this can be exported internationally. When I recently was in Paris and met with the Minister of Social Affairs from the Mitterand government, Madame duFois told me that in France they do not have the history of volunteerism that we have in America. But if American industry truly volunteered the funds and the time, the engineering talents, to make this program a success, she felt that she could sell it to the aerospace industries in France, who would then deal with the needs of French disabled citizens.

The possibilities are limitless.

Senator KENNEDY. Thank vou very much.

The CHAIRMAN. Thank you.

Senator Dodd.

Senator DODD. Thank you, Mr. Chairman, and welcome to the committee, Madam Secretary. It is nice to see you again.

Secretary HECKLER. Thank you, Senator.

Senator DODD. Let me just pick up on that last point that Senator Kennedy was raising with you. So much of what we are seeing developed in this area obviously is done at Government expense. We are paying, and we are a direct partner. I looked at the board here of various people from some of the major corporations in this country, most of whom are major contractors with the Government. And, of course, a lot of what is being developed is the tangential effect of other programs, obviously. One of the reasons I have long supported the Space Program and the NASA Program is not just because of what we were doing there, but because of the tremendous beneficial effect and the knowledge that is being accumulated through that process.

What should the relationship be as a result of taxpayers in a sense financing these programs; the very positive benefits that accrue that are identified throughout testimony here today?

What discussion have you had about proprietary interests of private corporations that have been able to develop these technologies and the cost of those technologies to the general public?

Secretary HECKLER. This initiative is prefaced upon an appeal to the aerospace and defense industries to use their special skills and talents to deal with the transfer of technology from space, defense development to the development of devices and to meeting human

needs on a voluntary basis through their efforts to just respond, and they have responded, to give of their talents, their funds. They have raised the money for this initiative. They have created a prototype for the State of Washington that can be replicated in every State, which can simplify the whole process of seeking help. They will, in the creation of the engineering teams, create very unique devices.

I do not know that we could put a price tag on, say, an orphan device for a person with multiple disabilities, because we are looking in this initiative at the most severely disabled and trying to compensate for their deficits.

I do not think we could put a price on the contribution of the engineers who will put their time in and then go beyond all that has been done.

In terms of the marketing, I think down the road that the development of these devices and the concentration on disabilities serves the whole society, as demographically we see our society becoming grayer and our population aging, and disabilities becoming more commonplace. But the more we respond and create devices to cope with disability, the more we avoid institutionalization and other costs.

In terms of specific device costs, I would see, I think, a definite explosion in the development of new devices, because the creativity that can be unleashed in this program if fully implemented across the country really has no limit. This will, through competition, I believe, lower some of these costs. But one of the points I made earlier, also, is that the data base in Seattle, WA, which has created the prototype for the whole system which can be replicated in every State—and would be, under this program—this data base provides for the exchange of equipment, allowing an individual who has a new, light wheelchair and needs a different type of wheelchair, to make it available to someone else—to sell it, to lease it, to rent it, or to give it to someone else, and the match is made to the computer.

Senator DODD. Yes; I am just worried about—what I am getting at is this. I remember, in fact, when I was in the House with you, doing a huge program in Connecticut on technology transfer that we had developed with the various governmental agencies, technologies that had developed, we had paid private contractors to develop. And then, to the extent they were able to come up with something that could be tremendously beneficial to the larger community, to what extent should the corporation be able to claim the proprietary interest, having used those tax dollars, but used them intelligently, developed something through their own ingenuity or the ingenuity of their employees, and yet the development of that technology could be of tremendous benefit to the country.

I think of one thing that you and I are particularly familiar with, the New England coastline, the Coast Guard, and the development of buoys operated through a solar-powered buoy mechanism. It was actually developed through a private contractor and then ultimately ended up in the public domain, but it took a rather long period of time.

What I am trying to get at is what responsibility do we have to try and either legislatively write in such a way that those kinds of

developments, financed with public money, should more quickly end up in the public domain? Should it be strictly volunteerism? I mean, this is not a question where these technologies would be developed necessarily in the private sector were it not for public research—not only the dollars, but public research, and the private corporations having advantage of that public research, if you will, and then coming back, something new develops. The corporation says, "Look, we spent a lot of money. This is our idea. We do not want to put this in the public domain where everybody can steal it from us"—that is their argument, and I am simplifying it a bit.

Ours is, my Lord, this could benefit everybody, and could benefit us immediately—lower the cost of Senator Kennedy's son's leg, for instance, or someone else's particular medical need. The company says, "Wait a minute, I do not want to have that out in the public domain. That is my own proprietary interest; I have developed that."

Where does that line get drawn? How do you try and mix those two?

Secretary HECKLER. I think it would be very difficult to actually draw that line. I think, frankly speaking, there has to be a balance between what serves the company in its own research and what serves a society.

In this initiative, we are looking at the voluntary and remarkably voluntary commitment of private companies to deal with the needs of the severely disabled, and to use company funds and time and engineering talent worth a fortune to intervene and create unique devices for severely disabled which would not be generally marketable. The whole concentration will, I think, produce a tremendous development and growth in new devices.

In terms of that sharing, I think it is very difficult to write laws that will deal with such unique experiences, but certainly, the first step for a company in giving back something that it has received, in giving back to a society the strength and its own profit, I think the first step is this step.

And I think in terms of drafting other laws, changing patents, putting things in the public domain, let us begin with this procedure and see what can be accomplished for the disabled. Let us give our applause to those companies that do participate, because they are not required to do so.

And I do not think we want to stifle the American genius that does produce new devices and at a profit, because those new devices are also creating an opportunity for people to live and for the company itself to prosper and others to prosper as a result of it.

So creating that balance is probably one of the most difficult tasks one could undertake, but I would begin by appreciating what we are doing here. Since the companies have said they will be committed to this project, it is up to us in Government to take them up on that commitment and, through betterment, to make it work and to expand this philosophy and this project not simply from Washington, but make it a realized goal and realized vision in every single State; simplify the process for the disabled, the process of getting assistance already available.

Right now, we have so many services that are not even utilized because it is so impossible for a disabled person, in many cases, to

find the right agency or organization or person who could meet their needs. And this system will at least, through the generosity of the private sector and their own commitment, begin to bring technology to individuals who are disabled, at no cost to the Government, at no cost to the individual.

I think it is an important beginning.

Senator DODD. Well, I could not agree more with you, and I am going a step beyond, obviously, to something we debated, I remember, a decade or more ago, in the Science and Technology Committee of the House, Mr. Chairman, that whole question of at what point does something—and should it be in the public domain or not. But I could not agree more with you that this is a tremendous beginning.

I am disappointed as I look down this list that there are not more Connecticut corporations involved, and we will see what we can do to interest some of them, as well.

But I commend you for it. I think it is a terrific beginning. And I commend as well the people who have already signed on with you, from Martin Marietta down to Lockheed. These are days when many of these corporations are the subject of other news stories, and I am particularly sensitive to it, since we have got a couple of Connecticut operations that are being mentioned with great frequency. I suspect this particular hearing will not receive the same degree of attention that yesterday's news stories did, nor should they necessarily, but I would hope that some people would take note that there are some wonderful things being done by some of these corporations.

The CHAIRMAN. I have a feeling we might have some more Connecticut corporations willing to get involved here after Senator Dodd's remarks. We hope so.

Senator DODD. Or St. Louis corporations that do a little business in Connecticut.

Secretary HECKLER. Well, Senator, I have to tell you that Harry Gray of United Technologies has been one of our strongest supporters and was at the White House ceremony yesterday, and so they are very involved. But I would encourage you to see to it that every company in Connecticut that can make a contribution—and there are so many, large and small—that they all become involved, because this is how we are going to truly make this concept a viable force in our lives and make a difference.

It is simply not enough to have a hearing, as you know.

Senator DODD. I agree, I agree.

Thank you.

The CHAIRMAN. Thank you, Senator.

Senator Kerry, we will turn to you. We were expecting a vote 5 minutes ago. I presume it will be momentarily.

Senator KERRY. That is all right. That is not unusual when I am about to question.

Senator DODD. You will get used to that after a while. Those cameras right on your neck feel wonderful. They know the back of your head from coast to coast.

Senator KERRY. Yes; the best known back of the head in the country.

For some of those corporations, Chris, the only work they may be able to find is this. [Laughter.]

Madam Secretary, I just have a couple of questions. I want to pick up with a variation of where Senator Dodd and Senator Kennedy were coming from, if I can.

Some of the professionals in this field have assured me that it is not so much lack of knowledge, it is not a lack of technical capacity that is a restraint on our ability to be able to provide some of these needed services, but it is far more the lack of the financial resources to be able to find the hardware, the software, the equipment, et cetera. That has been touched on a little bit.

I wonder—and perhaps, carrying Senator Dodd's question a little further—should we be thinking about some kind of set-aside of NASA or defense contract money of a certainly minimal percentage, perhaps, for this specific research and development, or should we be thinking about a specific application of an R&D tax credit or something along those lines, to get beyond the volunteerism, to try to maximize the impact that you have obviously underscored is available here? And if it is so available, and if it is so important, shouldn't we perhaps be doing something to hasten that process?

I say this, mindful of the fact that a number of people have stated—those who are involved in the volunteerism aspect of it—that their ability to provide the technical assistance is often greatly restrained by virtue of their need to drop the technical assistance in order to go out and find resources and to put the rest of it together.

So I wonder, with specificity to one of those two ideas, if you might give me your reaction.

Secretary HECKLER. I do not feel that it would be wise to draft any legislation that would institutionalize this program at this time. I think the most important element of a program is the fact that it does call upon the skills of these industries and their resources in a unique way.

I do not believe we could ever fund what we are going to do. We could not afford it. I really believe that the engineering talent alone, if it were costed out on an hourly basis, would be so prohibitive that really, we would find that to work for one single device, the Government would have to invest a tremendous amount of money. And then in Government, you always have the question of equality, because if you do it for one under a Government program you must do it for every single other individual in the category.

In this case, we are going to ask the private sector to go out and, in their own communities, in the technology teams, to interface one on one with the disabled, the severely disabled.

This will give us the data and the information as to how the program can work. I think at some later stage it would be appropriate, if private funding is not available and is not effective, adequate, to say perhaps we must institutionalize it

But frankly, you know, I have lived in the bureaucracy; having lived in the Congress for 16 years, I have now lived in the bureaucracy for almost 3 years. And I see the value, but I also see the cost. As soon as you institutionalize a program, you then have the administrative costs, the replication across the country of that, the overhang of administration, and the money does not go directly to

the beneficiary. This is one of the first times that we have had a grassroots vehicle for matching skills, resources, with the needs of the disabled. And I would rather see that tested, because I think we are going to achieve a great deal more through this system. But of course, the pressure must be kept on to achieve the system, to have it replicated—not by fiat, but by concern, by leadership in every single State. And I think every Governor who does not, for example, create a priority for the disabled at this time, with this particular initiative available, work on the prototype—the prototype is designed to be simplified and to be replicated at the minimum cost, with a system that will be able to speak to each other from Bangor, ME to Seattle, WA, and to share information on any problems that the disabled face and any solutions that they have found.

I would like to see the full potential of this dynamic initiative achieved through the private sector because I frankly think that the volunteer efforts that can go into this will pay such dividends for the companies, for the individual engineers, for the disabled, that to create an institution is to squelch that spirit. And I think at this point certainly we must applaud the spirit and we must see to it that the concept is actually implemented and becomes reality.

So I think it is just premature to really ponder those questions—and maybe we will never have to face them; possibly, we will. But that is an issue for a subsequent Congress to consider.

Senator KERRY. Well, I certainly appreciate it. I join you in applauding that spirit. And I also applaud, incidentally, the fact that you drew a distinction between the Congress and the bureaucracy. I was not sure there was one, so that is encouraging.

Secretary HECKLER. There is.

Senator KERRY. I think in your answer I clearly discerned a difference, and there is a distinction, obviously, between the technology teams, the technology net, and the development of, say, a new leg or the specific technology in hardware terms and even in software terms. And I am not sure—I agree with you that the technology net, technology team, et cetera, concept for the moment is far better than volunteer, and I would not want to dream of trying to institutionalize that, particularly when we do not even know yet what it fully is.

But I was wondering whether for the development of the actual R&D portion, not the individual engineer interfacing with a particular individual, but for the actual hardware development or R&D portion of the particular prosthetic piece or something else, whether that should not be subject to some kind of legitimate—we give incentives for countless other things with less public benefit and legitimacy—I wonder if that is not a direct economic spinoff?

Secretary HECKLER. I think that really, new devices are becoming available constantly. The market is changing. There have been a number of studies in the Congress. When I was on the Science and Technology Committee, we discussed and studied the issue of the transfer of technology. I have been interested in this for several years.

The fact is that the Office of Technology Assessment produced one of the finest documents ever made available to the Congress and then discussed why more devices were not being developed.

And the reason—there were many, of course—but I think one of the most basic reasons that there was not a greater number of devices is that there was not a focus on the needs of the disabled, and there was not a competitive market.

I believe that this initiative and its consequences, and also the graying of our population, demographics alone, will create new markets and the competitive instinct will produce a lower price, which will achieve the right ends that you and I both wish for in the course of progress.

Now, this initiative focuses on the disabled, but frankly, this is the first time we have had a major—major—national emphasis or focus of this type, and it can produce a new awareness, and new products will be the outgrowth, I am positive.

But I want to stress that what we are talking about today will be the development of, in the engineering phase, through technology teams, simple answers for disabled citizens and sophisticated devices that are fairly unique to the individual for which there would not be a commercial market, because the composite of deficits and disabilities from one person to another differs so greatly. These will be streamlined to individual needs. But I think we are going to see an explosion of devices, which will hopefully bring the price down.

In terms of a change in the patent law, in terms of public money and the tradeoffs between the public investment and the private and the public gain, I think that is a very, very difficult question in terms of resolving it. It is easy to discuss and hard to actually concretize in terms of a resolution, and it is premature at this time.

Senator KERRY. Just one last question. Are there any criteria, or by what means does the program contemplate making decisions about who gets help, which disabled person does or does not in this process receive assistance?

Secretary HECKLER. There is no formalized system at the moment, and I think there are other witnesses who can speak to this more ably than I. But as I envision the concept, and as I believe it is working in the State of Washington, which is the prototype State, the individuals will request help through the 800 number and then be provided with help through existing channels at the moment, because we are beginning by creating the technology net for every State which can clarify the maze of options; instead of having a disabled person go through a very complicated phone directory to find out what office could possibly even answer their questions, they will have one phone system and one 800 number, and get a response and information.

The severely disabled person who would be benefited by the tech teams when they are implemented would be the individual who has unique needs and is truly the most disabled, and this will be a function in part of geography. But in looking across the country, there are technological facilities and industries in every State, and it will be through the interfacing with those in their own community that individuals would be helped. The criteria would be the severe disabilities.

Senator KERRY. Well, thank you very much, Madam Secretary. I appreciate all that you have done on this. I think it is a tremendous beginning. I think it is a very important one. I think all of us are delighted that the private sector is responding and also that we

are looking for a way to try to do something through a private sector/public kind of partnership which does not require expenditure. So I think we are all delighted.

I understand we have a vote, Mr. Chairman.

The CHAIRMAN. We do. I thank you, Senator Kerry.

I echo Senator Kerry's accolades and want to thank you for taking time to be here with us and explain this program to us in more detail. I wish you well, wish this program well. I hope this committee can be of help to you and to this program in more ways than just one, more ways than just this hearing, and I intend to see that we do more in this area.

Madam Secretary, we know you are a very busy person, so we will not hold you here.

We will recess temporarily while we go and vote, and then we will begin with our first panel which will consist of one person, Mr. Robert Kirk, whom I will introduce when I get back.

We will recess for about 7 or 8 minutes.

Secretary HECKLER. Thank you, Mr. Chairman.

[Short recess.]

The CHAIRMAN. The committee will come to order.

Our next witness is Mr. Robert Kirk, chief executive officer of LTV Aerospace Corp. and chairman of the Executive Coalition.

As chairman of the Executive Coalition, Mr. Kirk has been working in the private sector to raise $3 million to assist individuals with disabilities, and he has done a terrific job. We want to express our appreciation for your leading actions to help the disabled and welcome you, Mr. Kirk.

We are trying to limit witnesses to 5 minutes each, however we will submit your written testimony in the record.

Please begin, Mr. Kirk.

STATEMENT OF ROBERT L. KIRK, PRESIDENT AND CHIEF EXECUTIVE OFFICER, LTV AEROSPACE CORP., AND CHAIRMAN OF THE EXECUTIVE COALITION

Mr. KIRK. Thank you, Mr. Chairman.

I welcome the opportunity to testify briefly on the impact of technology on human resources. I speak to this issue not as an engineer, but as an aerospace executive and as the incoming chairman of the Aerospace Industries Association of America, the national trade association representing U.S. companies engaged in aerospace and defense activities.

Our industry is unique. Its scientists, engineers, and technicians are totally engaged in developing, testing, and producing high-technology products and systems which directly benefit our space and defense programs. These technologies clearly have tremendous potential to assist the severely disabled.

Health and Human Services Secretary Heckler approached our industry last spring and asked us to take the lead in a new public/private sector initiative. Her initiative was designed to bring about a better exchange of information to further the application of aerospace technology to benefit the disabled. Clearly, no higher purpose can be found than to apply the ingenuity of man in ways that

permit the handicapped to become more independent and more productive members of society.

President Reagan's proclamation of the National Decade of Disabled Persons calls upon Americans in both the private and public sector to assist the disabled, and it is in keeping with this spirit that I was asked by Secretary Heckler to serve as the chairman of the Coalition of High-Technology Industries for the Disabled. At the time of my acceptance, I told Secretary Heckler that our industry has been accustomed to challenges since the dawn of flight. We are believers in the spirit of public service and have a long, successful track record in dealing with hostile environments. The technologies that enable people to survive and be productive in space can permit the severely disabled to overcome the myriad difficulties they encounter in their daily lives.

We produce commercial jet transports and supersonic military aircraft. We built aircraft small and large, those that hover and those that fly at three times the speed of sound. In the aftermath of Sputnik, we met President Kennedy's challenge to put a man on the Moon within a 10-year period. What seemed impossible became real and today, thanks to the Government-industry team, space flight is almost a routine activity, and indeed improved rocketry and reusable space shuttles have transformed the space age well beyond those early experiments into the unknown.

With that in mind, we formed an outstanding Executive Coalition and accepted Secretary Heckler's challenge with optimism and confidence. Our objectives are threefold: To first conduct an initial fundraising effort to establish the program within the aerospace industry; later, the coalition will include other high-technology industries such as computers and communications; second, we were asked to identify and inventory current private sector initiatives to help the disabled; and third, to suggest possible approaches to carry out the future phases of the program.

I am pleased to report to you that our efforts to date have been successful and encouraging. Financial commitments from the industry will permit us to launch a Washington office to serve as the coalition's national headquarters. In 1986, this office will be in place, a director appointed, and the coalition will expand to include other high-technology industries.

Our second objective, to identify current industry initiatives, is also well underway. An inventory checklist was designed by Concepts for Independent Living personnel in Seattle, WA, together with staff members of the Department of Health and Human Services. The inventory was tested by the Boeing Co., and has been distributed to all of our companies in our industry. The inventory will determine the extent of our many existing volunteer programs. It will be completed in January 1986 and will be collated and turned over to Concepts for Independent Living to be included as part of their TechNet and Tech Team programs. You are going to hear more about these programs shortly from George Arrowsmith of Concepts for Independent Living.

We have taken a first step, and much more must be done, but I am confident that American technology is fully capable of making a better world here on Earth, and perhaps one day even permitting a handicapped individual to venture into space aboard the shuttle,

simply because one of our devices has given him or her newfound independence and productivity.

Whether such breakthroughs permit the handicapped to work on Earth or in space is a challenge that our industry welcomes.

We thank you very much.

[The prepared statement of Mr. Kirk and responses to questions of Senator Hatch follow:]

STATEMENT OF ROBERT L. KIRK

PRESIDENT AND CHIEF EXECUTIVE OFFICER

LTV AEROSPACE AND DEFENSE COMPANY

BEFORE THE UNITED STATES SENATE COMMITTEE

ON LABOR AND HUMAN RESOURCES

Mr. Chairman and members of the Committee:

I welcome the opportunity to testify before you on the impact of technology on human resources. I speak to this issue not as a scientist but as an aerospace executive, and as the incoming chairman of the Aerospace Industries Association of America, Inc. (AIA). The AIA is the national trade association that represents U.S. companies engaged in aerospace and defense activities.

Our industry is unique in the fact that its member scientists, engineers and thousands of technicians whose daily work requires them to be totally engaged in developing, testing and producing high tech products and systems which directly benefit our space and defense programs but which also have tremendous spin-off potential for civilian application.

Because of this, Health and Human Services Secretary Margaret Heckler approached our industry last spring and asked us to take the lead in a new public/private sector initiative. This initiative would, she believed, help bring about a better exchange of information to further the application of aerospace technology to benefit the disabled. Clearly, no higher purpose can be found than to apply the ingenuity of man in ways that permit the

handicapped to become more independent and more productive members of society. Certainly those individuals also want to participate as fully as they can in life.

In keeping with the objectives on President Reagan's proclamation of the National Decade of Disabled Persons calling upon Americans in both the private and public sector, I was asked by Secretary Heckler to serve as the chairman of the Coalition of High Technology Industries for the Disabled. At the time of my acceptance I told Secretary Heckler that our industry has been accustomed to challenges since the dawn of flight. We believe that our track record in solving difficult problems is well established.

In the 1940's President Roosevelt challenged the industry to design, develop and produce 50,000 aircraft each year. We met that challenge.

Later we met the challenges of producing commercial jet transports and supersonic military aircraft. We have built aircraft small and large, those that hover and those that fly at three times the speed of sound.

In the aftermath of Sputnik, we met President Kennedy's challenge to put a man on the moon within a ten year period. What seemed impossible became real. Today, thanks to the government-industry team, space flight is almost a routine activity. Indeed, improved rocketry and reusable space shuttles have transformed the space age well beyond those early experiments into the unknown.

With that in mind we accepted Secretary Heckler's challenge with optimism and confidence.

I am very fortunate to have an outstanding executive committee to assist in this task. They are:

Thomas Pownall	Chairman of the Board and CEO	Martin Marietta
T. J. Murrin	Pres., Energy & Advanced Group	Westinghose Electric Company
D. Brainerd Holmes	President	Raytheon Company
Roger Smith	Chairman of the Board	General Motors
Charles Locke	Chairman of the Board and CEO	Morton Thiokol
Robert Anderson	Chairman of the Board and CEO	Rockwell Int'l. Corp.
Malcolm T. Stamper	Vice-Chairman	The Boeing Company
Jack L. Heckel	Chairman of the Board	Aerojet General Corporation
Roy Anderson	Chairman of the Board and CEO	Lockheed Corp.

Our objectives are three-fold. They are:

1. Conduct an initial fundraising effort. This will produce seed money to establish the program within the aerospace field. Later, the coalition would include other high tech industries, i.e., computers, communications and transportation.

2. Identify and inventory current private sector initiatives to help the disabled; integrate and exchange the inventoried information.

3. Suggest possible approaches to carry out the future phases of the program.

I am pleased to report to you that our efforts to date have been successful and encouraging. We are well on our way to our dollar goal. Commitments from the industry will permit us to launch a Washington Office to serve as the coalition's national headquarters. In 1986, this office will be in place and a director appointed. The coalition will expand to include other high tech industries.

Our second objective, to identify current industry initiatives, is also well under way. An inventory checklist was designed by representatives of Concepts for Independent Living in Seattle, Washington, together with staff members of the Department of Health and Human Services. The inventory was tested by the Boeing Company and has been distributed to all of the companies in our industry. The inventory forms will be completed in January 1986 and will be collated, turned over to Concepts for Independent Living and will be included in their TECHNET and TECH REP programs. You will hear more about these programs when Jack Pierce, Chairman of Concepts for Independent Living, testifies later this morning.

Why is all this activity important? The answer is simple. Today there are approximately 35,000,000 disabled Americans. Although many companies have employees engaged in activities intended to benefit disabled persons, the results -- while dramatically good for a few people -- are still not widespread. For example, Westinghouse Company has more than 250 technicans and engineers in Baltimore who are engaged in a program called Volunteers for Medical Engineering. When asked to develop a device for a disabled person, an engineer in the group volunteers his time and knowledge, and is supported by

the company in the use of tools, equipment and in some cases material. The engineer designs and builds the device, an individual disabled person is helped. This is wonderful, but what of the thousands of other disabled people in America who might be aided by a similar device?

We believe the way to increase the reach of such assistance is through a national network to disseminate information to individuals with disabilities, physicians, and private organizations regarding technological products and services which are currently available. We must close this information gap. Secondly, we must recruit volunteers, researchers, scientists, engineers, and other skilled professionals who would apply their skills and technical knowledge to aid Americans with disabilities. Unlike organ transplants, we are not seeking a collection and distribution system to facilitate surgery. Rather, we are trying to make known technological solutions which may have many potential variations and applications.

We have taken a first step and much more must be done, but I am confident that American technology is fully capable of making a better world here on earth and perhaps one day even permitting a handicapped individual to venture into space aboard the shuttle, simply because one of our devices has given him or her newfound independence and productivity. Whether such breakthroughs permit the handicapped to work on earth or in space, it is a challenge we welcome.

aerospace NEWS

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.
1725 DE SALES STREET, N.W., WASHINGTON, D.C. 20036 TEL 429-4656

OFFICE OF PUBLIC AFFAIRS

For Immediate Release

Contact: Ann McCracken
(202) 638-2800

PRESIDENT REAGAN HONORS SECRETARY HECKLER AND AEROSPACE INDUSTRY FOR THEIR COMMITMENT TO DISABLED CITIZENS

(Washington, Dec. 3)---President Ronald Reagan today commended Health and Human Services secretary Margaret Heckler and leading aerospace and high technology companies for their sponsorship of the National Initiative for Technology and the Disabled, (NITD).

In the White House ceremony, President Reagan said, "If we could give astronauts jetpacks, couldn't we give the disabled a better wheelchair? If we could enable a spacecraft orbiter to talk to Houston Control, couldn't we help those with speech impairments? And so it was that an exciting partnership between the government and private sector was born - the National Initiative for Technology and the Disabled."

The program is the first national public-private sector effort in this field and will be directed primarily at Americans with severe disabilities. The program is a joint effort by: the Departments of Health and Human Services and Defense; the National Aeronautics and Space Administration, and leading companies of the Aerospace Industries Association.

Secretary Margaret Heckler said, "We have the imagination, knowledge and resources in this nation to take us into the future - a new future for the disabled. The leaders in this room today who have led and financed America's great technological present and future can work to make this a better world for all of us, especially for those with limitations or disabilities."

A national communications and informational network, named Tech-Net (Technology Enlisted to Conquer Handicaps) is expected to be operational nationwide by the end of 1988. The toll free number began in the state of Washington in August, and will be added in Kansas, Pennsylvania, Massachusetts, and Texas by the end of 1986. The 800 number will be manned by persons with disabilities.

Tech Teams, or local teams of professional engineers and technicians, will be organized at aerospace and other high-technology companies in which they are employed. These individuals, volunteering their time and skills to work directly with Americans with disabilites will create unique ad hoc devices tailored to individual needs for increased independence.

Robert L. Kirk, president and chief executive officer of LTV Aerospace and Defense Company and chairman of the Executive Coalition of NITD, and the Coalition were recognized by President Reagan. President Reagan said, "I know each of us wants to express our deep gratitude to Bob Kirk, the head of the Executive Coalition. The Initiative would be nothing without its many participants. So it is that I want to thank you - the men and women who gave this initiative drive and substance. Technology can lift our hopes and dreams."

Concepts for Independent Living, the 501C3 funding repository, is the national integrator for the program. At the White House Ceremony, Mr. Kirk announced that the initial fundraising drive is well on its way to its goal. There is currently an operational center in Seattle, WA and a national headquarters is being opened in Washington, DC.

On Wednesday, Dec. 4, Senator Orrin Hatch (R-UT) will hold hearings on the impact of space technology on human resources. The Senate Labor and Human Resources Committee will hear testimony from Secretary Heckler and Mr. Kirk as well as handicapped persons and individuals who have worked directly with handicapped persons. The hearing will be held at 10:00 am in SD-430 of the Dirksen Senate Office Building.

An estimated 35 million Americans have physical developmental, mental or sensory disablities. In an effort to enhance the independence, freedom, and dignity of individuals with disabilites, President Reagan proclaimed the years 1983-1992 as the Decade of the Disabled.

###

Note: A list of the Executive Council of NITD is attached.

EXECUTIVE COUNCIL OF THE COALITION OF

HIGH-TECHNOLOGY INDUSTRIES

Robert L. Kirk -	President and Chief Executive Officer LTV Aerospace and Defense Company
Thomas G. Pownall -	Chairman of the Board and Chief Executive Officer Martin-Marietta
Charles Locke -	Chairman of the Board and Chief Executive Officer Morton Thiokol
Malcolm Stamper -	Vice Chairman Boeing Company
Jack L. Heckel -	Chairman of the Board Aerojet-General Corporation
D. Brainerd Holmes -	President Raytheon Company
Roger B. Smith -	Chairman of the Board General Motors Corporation
T.G. Murrin -	President, Energy and Advanced Technology Group Westinghouse Electric Corporation
Roy A. Anderson -	Chairman of the Board and Chief Executive Officer Lockheed Corporation
Robert Anderson -	Chairman of the Board and Chief Executive Officer Rockwell International Corporation

Questions for Mr. Kirk
Submitted by Senator Hatch

1. As you move into phase two of the program, what will your role be?

Answer:

During phase two of the program, I expect to continue to support the program. For example, I have offered office space in the LTVAD Washington office as a first step in establishing a Washington office for the coalition. When a director is appointed, he or she could work out of our office until such time as a program plan and time table is developed, personnel recruited, and appropriate space leased. During my tenure as Chairman of the Aerospace Industries Association of America, I will continue to encourage our industry to participate with its technical and scientific personnel and funding. Also, I will be available to provide advice and assistance in expanding the initiative to other high tech industries. Having taken this important first step, I will certainly do everything I can to see it grow and prosper into a full fledged National program to benefit the severely disabled.

The CHAIRMAN. Well, thank you, Mr. Kirk. I am proud of the work that you have done here.

I notice that on this Executive Coalition, you have got some very strong people: Thomas Pownall, chairman of the board and CEO of Martin Marietta; T.J. Murrin, president, energy and advanced group of Westinghouse Electric Co.; D. Brainerd Holmes, the president of Raytheon Co.; Roger Smith, the chairman of the board of General Motors; Robert Anderson, chairman of the board and CEO of Rockwell International Corp.; Malcolm T. Stamper, vice chairman of the Boeing Co.; Jack L. Heckle, chairman of the board of Aerojet General Corp., and Roy Anderson, chairman of the board and CEO of Lockheed, and one of my personal friends, Charles Locke, chairman of the board and CEO of Morton Thiokol. I think that is a pretty doggone great board.

Mr. KIRK. It is a good group, a super bunch of people.

The CHAIRMAN. I would say it is. I am very impressed with what you have done. I am also impressed that you have grabbed the bull by the horns and gone out and tried to raise some of this money and will raise the money in the future.

Let me tell you what we will do, or at least one of the things that we will do. We will hold an oversight hearing sometime next year to see how this is progressing, what advancements have been made, and let the rest of the world know, as a followup to this hearing, what you folks are doing in the interest of the handicapped. I think it needs to be explained over and over again. So we will try to give you resource backup here—plus we will be continually looking to

see if there are ways that this committee and others here on the Hill might be able to augment the work that you are doing. We would prefer it to be private sector; we would prefer it to be voluntary. We would prefer it to be a combination of private sector/Government work. I am very impressed with what you have done.

Mr. KIRK. I appreciate it, Senator.

The CHAIRMAN. Can you tell me what the future plans for your Executive Coalition are?

Mr. KIRK. Yes. We are in the process of getting the office established in Washington. We are going to get lined up with the other industries, communications and computers being two obvious examples that we are going to go at now——

The CHAIRMAN. You mentioned transportation, as well.

Mr. KIRK. And transportation as well. But then, while we are doing that, the people from Concepts for Independent Living, who are actually going to administer the program will be setting up their Tech Teams and their TechNet. The initial thrust has been in the State of Washington, we expect to expand it to Massachusetts, Pennsylvania, Kansas, and Texas, and from there, the rest of the States and the world, for that matter.

The CHAIRMAN. Well, in your initial testimony, you indicate to us that you are on your way to meeting your financial goal of raising $3 million.

Mr. KIRK. Right.

The CHAIRMAN. Can you tell us where you are and how soon you expect to be able to reach that goal?

Mr. KIRK. Well, we are well over $1 million now, and we are going to keep on working through the early part of 1986 to get up to the amount that we need. We have enough money to get started, and that was the important first step that we had to take.

The CHAIRMAN. Well, Mr. Kirk, I salute you. I salute you and the other people in industry who are willing to do this. I am very impressed. I think Mrs. Heckler is extremely impressed, and this is a wonderful way for her to leave HHS and leave a legacy there—this is one of many that she will leave, but certainly, one of the important ones—and to go on and do her work in Ireland which of course is, in my opinion, a very important post.

Mr. KIRK. We wish her well. She has been an extremely effective person. Without making too light of it, I have commented that I was in danger of becoming disabled myself if I had not said "Yes" when she asked me to volunteer. [Laughter.]

The CHAIRMAN. I understand that very well, because she has a pretty good way of twisting arms, I will tell you. She is really something.

Mr. KIRK. Our industry has always led the way, we think, in volunteer programs, in United Way and other local programs across the country, and we are very proud to be associated with this one.

The CHAIRMAN. Well, this is the kind of thing that I think helps all Americans to be proud of industry and business in general. I just hope that you reach that goal of $3 million and that we will get many, many other companies involved across this Nation who will be willing to participate.

Mr. KIRK. I hope so.

The CHAIRMAN. Well, thank you so much for being with us.

Mr. KIRK. Thank you, Mr. Chairman.

The CHAIRMAN. Now we will call the three witnesses on our next panel. First, I would like to introduce Ms. Susan Yim. Ms. Yim suffered a brainstem stroke 4 years ago, making her a quadraplegic and unable to speak.

Second, I would like to introduce Mr. Thomas Murphy. Mr. Murphy was in a diving accident 14 years ago which left him paralyzed from the neck down.

And our third witness is Ms. Kathleen Cissna. Ms. Cissna is a former police officer who is now living with an Eli Lilly defibrulator.

I look forward to hearing each of your testimonies. I understand that Ms. Yim will have her aide, Ms. Diane O'Brien, read the testimony that Ms. Yim has prepared with her communications device. Later she will answer questions with the help of this device and we will get an opportunity to see how it works.

So, Ms. Yim, we will begin with you and will have your aide read your statement.

STATEMENT OF SUSAN YIM, A QUADRAPLEGIC WHO USES A COMPUTER TO COMMUNICATE; THOMAS MURPHY, A QUADRAPLEGIC FROM THE MARYLAND REHABILITATION CENTER; AND KATHLEEN CISSNA, A FORMER POLICE OFFICER AND RECIPIENT OF AN ELI LILLY DEFIBRULATOR

Ms. O'BRIEN [for Ms. Yim]. I am 27 years old and suffered a brainstem stroke in June 1981, resulting in quadraplegia and complete inability to speak. There were no predicting symptoms, as far as I know. It just happened one day. It is a very scarey and weird feeling to just wake up one morning and be unable to move or talk. Suddenly, you find yourself in a very frightening, frustrating and foreign environment.

Prior to the onset of the stroke, I was working in a molecular biology lab at Duke Medical Center in Durham, NC. I had gotten my bachelor's degree in biology from UMBC and was taking some graduate courses toward a pathology degree.

I think, by far, the most difficult obstacle to overcome is the inability to communicate. Several different therapists proposed various extremely tedious and time-consuming methods by which I could communicate, but I found these systems so frustrating and unsatisfactory that, for a time, I just preferred to say nothing.

Fortunately, an engineer friend developed my current system about 5 months after I had the stroke. This system operates with a box which translates Morse code, which I input via very sensitive bulbs I operate with my thumbs, into English letters on a digital readout. Because this communicator is portable, it allows me great freedom to carry on with my life as much as possible following the stroke.

For example, I can still, relatively comfortably, go out to restaurants and parties and attend school. Since the stroke, I have taken five courses at local colleges. My Morse code device can hook into a computer to type and print out school work or other communications.

Now I am looking for a job, also. I am well-qualified both educationally and experience-wise, to work as a scientist. But despite massive efforts, I remain unemployed. Because of existing prejudices, and unwillingness to make slight changes in the work environment, vocational opportunities for the disabled person are slim.

The public must be educated and made aware of the potential of the disabled population. With increased technology and adaptive devices, fulfilling and productive lives are possible for all.

Continuation of my own lifestyle following the stroke would not have been possible without my personal communication devices.

As for future goals, I would very much like to be involved in the Space Program and ideally, to be the first disabled person on the space shuttle. I think the effects of zero-gravity and antigravity on physical handicaps, either on land or in space, would be very interesting.

I have also investigated jobs in translating Russian or in computer technology at NASA.

Again, none of this would have been possible without the aid of my communicator box.

I meet disabled people all the time in similar predicaments as myself who are just fascinated with my communicator, and in desperate need of a similar device. These people all have very good minds, but are simply physically locked in. While many disabilities cannot be prevented, it is possible to incorporate disabled people into the general population with increased development of communicating devices and technology.

The CHAIRMAN. Thank you very much. Your inspiring testimony demonstrates what the human spirit can do. Coupled with science, we can accomplish just about anything. It is important to us to have you here today. I think what I am going to do for the purpose of this hearing is ask you just one question, and then I would like you to use your communicator, and then Diane, your aide can read to us your response.

What do you think is the most effective way to change the public's prejudice against disabled persons?

Ms. O'BRIEN [for Ms. Yim]. More education; educating the public.

The CHAIRMAN. More education. That is great. I hope we can help you find a job in science, in an industry where your talents can be used. We are very proud to have you with us today and proud of your ability to fight back and do the things that you have been able to do since you have been disabled.

Thank you. And I want to thank you, Ms. O'Brien, for being here with us today and helping us on this.

Let us turn to Mr. Murphy at this time and let us hear your testimony, Mr. Murphy.

Mr. MURPHY. On August 10, 1971, I broke my neck in a diving accident in Ocean City, MD. Since then, I have been paralyzed from the neck down, a C-4-5 quadraplegic. I was 16 years old at the time.

After the accident, I was transferred to Western Maryland State Hospital in Hagerstown, MD, where I spent the next year and a half. In addition to therapy, I received tutoring for grades 11 and 12. Upon graduation, I was discharged and returned home to my

family in Hyattsville, MD, where I remained for the majority of the last 12 years. I am the second-oldest in a family of nine.

Between 1973 and 1980, I have taken courses at Prince Georges Community College, Boston University, and the University of Maryland, where I graduated from the University of Maryland at College Park, with a BA in psychology.

It was while attending the University of Maryland that the Washington Metropolitan Area Transit Authority lift-equipped buses began service for the handicapped.

With the cost of a van prohibitive for myself and family, I had hoped the lift-equipped buses could provide a means of transportation other than having to depend on my family. Unfortunately, from the inception of the service through December 1980, the dependability of the service was disappointing.

The jobs I have applied for, I either did not feel confident about the reliability of transportation to certain locations, or did not qualify due to lack of work experience.

As family members gradually moved away from home, the majority of my care was taken up by the few still living at home. In addition, the past few years I have experienced an increase in medical problems. These factors all combined to generate a reluctance on my part to chance getting a job using Metrobuses as a sole means of transportation. The last couple of years, I have become less active and more isolated. It was against this backdrop that I sought assistance from DVR and inquired about admission to the Computer Training Program at Maryland Rehab Center.

The training program interested me for several reasons. It has a proven track record of actual job placement for those who complete the program. Also, computer programming is more mental than physical, and does not necessarily have to take place at the jobsite. The facet of the program that was most important to my situation from a work standpoint—aside from learning computer programming itself—was the integration of on-the-job training and job placement assistance.

Without formal work experience since the onset of my disability, the on-the-job training affords me the opportunity to actually make whatever adaptations are necessary to function at an actual jobsite. This includes having a knowledgeable staff, experienced at getting the most out of whatever physical abilities a person possesses.

The other exciting opportunity that coincided with my acceptance into the training program was the ability to participate in a research project entitled, "Microcomputer Applications for Persons with Severe Disabilities in Home, Community, and Vocational Settings." The primary purpose of the project, funded through the National Institute of Handicapped Research, is to assess how the application of microcomputer technology can benefit a physically handicapped person's needs as related to achieving maximal independence. This is achieved through the systematic assessment of the individual, the needs of the individual, and the technology that will meet these needs.

In my case, this assessment process resulted in the recommendation and acquisition of a portable laptop microcomputer, which I can control with minimal assistance. The microcomputer enables me to store, retrieve, manipulate text and data that would not oth-

erwise be possible. Also, while I do not require a special keyboard, I am able to utilize software that increases my typing efficiency. For instance, one software program allows me to program one or two keystrokes that represent numerous keystrokes. Another program allows me to eliminate the necessity of hitting two keys simultaneously, which I have difficulty doing, when involving the control shift alternate keys.

In addition, I will have the ability to access the mainframe computer used in the training program. This represents a dual use of technology in my case, utilizing a microcomputer as a means to be trained by allowing me to write independently and at the same time allowing me to have access to an employment tool, the mainframe computer. The impact of the technology will be evaluated over a 2-year period, with followup services and training provided.

For the present, I will utilize the microcomputer from the research project to enhance my ability to successfully complete the training program. I am also exploring just what alternatives in independent living exist, such as accessible housing, transportation, and attendant care. With these components, I may be able to relocate near an eventual job site with access to a workable transportation system.

In conclusion, I have a long way to go and many plans to develop and work out. With hard work and the opportunity to participate in programs such as I have mentioned, I feel I have taken an important step toward a more independent and productive future.

[The prepared statement of Mr. Murphy follows:]

To: Senate Committee on Labor and Human Resources

From: Thomas E. Murphy

On August 10, 1971 I broke my neck diving from a pier into the Chesapeake Bay at Ocean City, Maryland. Since then I've been paralyzed from the neck down, a C 4-5 quadraplegic. I was sixteen years of age at the time of the accident.

A couple months after the accident I was transferred to Western Maryland State Hospital in Hagerstown, Maryland where I spent the next year and a half. In addition to therapy, I recieved tutoring for eleventh and twelth grade. Upon graduation I was discharged and returned home to my family in Hyattsville, Md.. For the majority of the past eleven years my family has cared for me. (I am the second oldest from a family of nine--three brothers and five sisters)

In August of 1973, I enrolled in Prince Georges Community College eventually completing approximately fifty-five credit hours towards an A.A. degree in General Studies. In August of 1977, I attended Boston University for a semester and lived on campus. This was my first experience in an independent living setting/program and while it was an important learning experience, I don't feel I was adequately prepared or organized for the adjustment to living independently.

In August of 1978, I transferred to the University of Maryland and graduated in December of 1980 with a B.A. in Psychology. It was while attending Md. University that the Washington Metropolitan Area Transit Authority lift-equipped buses began service to the handicapped. With the cost of a van prohibitive for myself and family, I had hoped the lift-equipped buses could provide a means of transportation other than having to depend on family members to take me to and from school. Unfortunately, from the inception of the service through December, 1980 the dependability of service was disappointing. Since graduating from the University of Md. I've taken three courses in data processing from Prince Georges Community College.

The jobs I have applied for I didn't feel confident about the reliability of transportation to certain locations or didn't qualify due to lack of work experience. As family members gradually moved away from home, the majority of my care was taken up by the few still living at home. In addition, the past few years I've experienced an increase in medical problems. These factors all combined to generate a reluctance on my part to chance getting a job using Metro buses as a sole means of transportation. The last couple of years I have become less active and withdrawn. It was against this backdrop that I sought assistance from DVR and inquired about admission to the computer training program at MRC.

The training program interested me for several reasons. It has a proven track record of actual job placement for those who complete the program. Also, computer programming is more mental than physical and doesn't necessarily have to take place at the job site. The facet of the training program that was most

important to my situation from a work standpoint (aside from learning computer programming) was the integration of on-the-job-training and job placement assistance. Without formal work experience since the onset of my disability, the on-the-job-training affords me the opportunity to actually make whatever adaptations are necessary to function at an actual job site. This includes having a knowledgeable staff, experienced at getting the most out of whatever physical abilities a person possesses.

The other exciting opportunity that coincided with my acceptance into the training program was the ability to participate in a research project entitled "Microcomputer Applications for Persons with Severe Disabilities in Home, Community and Vocational Settings". The primary purpose of the project, funded through the National Institute of Handicapped Research, is to assess how the application of microcomputer technology can benefit a physicelly handicapped persons' needs as related to acheiving maximal independence. This is achieved through the systematic assessment of the individual, the needs of the individual and the requirements of the computer system which will meet these needs. In my case, this assessment process resulted in the recommendation and acquisition of a totally portable laptop microcomputer which I can control totally and allows me to have access to the mainframe computer used in my training program. The funding structure assures that recommended equipment can be purchased for each individual project participant. The impact of the technology will be evaluated over a two year period with follow-up services and training provided.

While at the Maryland Rehabilitation Center I'm also exploring just what alternatives in independent living exist that might be neccessitated by getting a job.

For the present, I'll utilize the microcomputer from the research project to enhance my ability to successfully complete the training program. This represents a dual use of technology in my case, utilizing a microcomputer as a means to be trained by allowing me to write independently, and at the same time allowing me to have access to an employment tool, the mainframe computer. My goals at present are to finish the computer training program, complete a work experience as part of the training, locate suitable employment and appropriate accessible housing that would include access to a workable transportation system.

In conclusion, I have a long way to go and many plans to develop and work out. Fortunately, the initial steps have been completed and were made possible because rehabilitation programs are beginning to use new forms of technology, including microcomputers, which allow previously unattainable goals to become a reality.

The CHAIRMAN. Thank you Mr. Murphy for your impressive testimony. Your persistence and hard work to reach your goal is truly an inspiration.

You mentioned that your experience with the Washington Metropolitan Area Transit Authority's lift equipment for the handicapped has been a disappointment. What is the current situation with that service? Is it still a disappointment, or have they improved it?

Mr. MURPHY. I have tried taking it a few times in the last couple years, and it still seems to have some problems that have to be worked out.

The CHAIRMAN. I see. Now, you mentioned that as your brothers and sisters have grown, your care has been provided by the few people still living at home. Have you been able to obtain home health care services from other health agencies, or from home health agencies?

Mr. MURPHY. I have only tried on one occasion to actually locate an attendant, and I did not have much luck in that.

The CHAIRMAN. It's unfortunate you were not able to find an attendent. This committee is working hard to try and get home health care to people like you. We think it will save money in the long run, while allowing you to be in your homes or in environments where you are happiest.

I want to tell you how proud I am of you, and that we appreciate your testifying before the committee today. We commend the industrial people who work to improve the quality life for people like you and, all of us.

Let me turn now to our last witness, Ms. Cissna. We are grateful to have you here today. We will take your testimony at this time.

Ms. CISSNA. My name is Kathleen Cissna. I am 33 years old and employed now as a legal secretary in Burlingame, CA.

Prior to this, I was a dispatcher for Burlingame Police Department for 7 years. I enjoy athletics, daily workouts on the Nautilus, roller skating, biking, et cetera. I live a very busy, active life.

I also have an automatic implantable defibrulator—a device inside me that monitors my heart rhythms and responds to them with an electrical shock if my heart begins beating at an abnormally fast rate. This device is a necessity for me because I have suffered two sudden death episodes when my heart began defibrulating, or beating so rapidly that it could not pump blood. A rhythm of that type could kill me within minutes.

I owe some of the freedom I have today to the fact that this implantable medical device was available to my physicians in the fall of 1982 when I needed it. This device is small, about the size of a deck of cards, and is implanted in the left side of my abdomen. I do have here what the device looks like, with the wires that attach up and the patch that goes right to the heart.

The CHAIRMAN. And that is implanted within your body?

Ms. CISSNA. It is implanted down right below my waistline.

The CHAIRMAN. But the actual electric device is within?

Ms. CISSNA. It runs off the battery pack, and then there is a patch, here, that is sewn onto your heart, and the wires run up.

The CHAIRMAN. I see.

Ms. CISSNA. It has not interfered with any of my physical or other activities. The discomfort is only in some of the new clothes styles that I occasionally find I cannot wear.

I am very thankful for the research efforts that brought the implantable defibrulator this far in its development, because I would not feel comfortable now living without it. I thank God every day for the technology that allowed such a device to be developed, and I applaud research efforts to bring us future devices that will be smaller and more sophisticated.

The experiences I have had over the past 3-plus years have changed my life. My life has been saved more than once by total strangers and also by a loved one, who have come to my aid at those times. I feel a strong desire to do what I can to help others, particularly those who, like myself, have potentially dangerous heart rhythms.

I have visited a number of these people in hospitals as they wait for or recover from implants of their defibrulators. I think I can speak for others like me in saying that we wholeheartedly support efforts to encourage the development and furthering of medical technology of this type.

If I can leave you with that thought, I have fulfilled my goal in speaking today—to benefit others because of the knowledge and experience I have gained.

The CHAIRMAN. Well, thank you. I think it is wonderful for you to come here and share your experience with us.

Can you tell us the approximate cost of your automatic defibrulator device?

Ms. CISSNA. I do not think you could put a cost value on it, because I am here, but probably I think for the device itself and surgery, it is somewhere around $20,000 to $25,000.

The CHAIRMAN. Is this technology readily available today, or is it still in the research phase?

Ms. CISSNA. Well, it was just FDA-approved within the last few months.

The CHAIRMAN. Do you have any idea how many individuals might benefit from a device like yours?

Ms. CISSNA. So far, about 700 already have. I was the 11th patient at Stanford, and Stanford now has done over 200.

The CHAIRMAN. And you feel that this device has saved your life, has improved the quality of your life, and has allowed you to live normally.

Ms. CISSNA. Definitely.

The CHAIRMAN. And you are acting now as a legal secretary in Burlingame, CA?

Ms. CISSNA. Right.

The CHAIRMAN. Well, that is wonderful.

I think all three of you have indicated what can be done and what is ahead for us if we are willing to push this voluntary effort to help people with disabilities. There are thousands of people who could benefit from the technologies that we have learned of today.

I want to restate how impressed I am with Secretary Heckler's initiative to address the needs of the disabled and Mr. Kirk and others who are the frontiers of this great endeavor.

Most of all, we are very honored to have all four of you here with us today, and for the testimony that you have given, each of you in your own way.

I want to thank you for being here. We appreciate it.

Ms. CISSNA. Thank you.

The CHAIRMAN. We will now move to our third panel. The first witness on our third panel will be Mr. George Arrowsmith, a TechNet Systems design manager for Concepts for Independent Living.

Mr. Arrowsmith has worked to forge a bridge between science and society, to make technology available to individuals with disabilities and to offer support for their families.

We will also hear from Dr. Lester Cory, a professor at Southeastern Massachusetts University and winner of the President's Volunteer Action Award of 1985, for the support he has provided to individuals with disabilities.

So we will begin with you, Mr. Arrowsmith, and we ask that you both limit your oral testimony to 5 minutes.

We appreciate having both of you here with us today.

STATEMENT OF GEORGE ARROWSMITH, TECHNET SYSTEMS DESIGN MANAGER FOR CONCEPTS FOR INDEPENDENT LIVING, ACCOMPANIED BY TOM CUSWORTH, GRADUATE; AND PROFESSOR LESTER W. CORY, SOUTHEASTERN MASSACHUSETTS UNIVERSITY AND WINNER OF PRESIDENT'S 1985 VOLUNTEER ACTION AWARD

Mr. ARROWSMITH. Mr. Chairman, thank you for asking us to testify today. I would like to also extend the regrets of Mr. Jack Pierce, who was called away on urgent business.

The CHAIRMAN. Well, we feel badly that Jack is not here, because he has been one of the integral people who has played a major role in helping the Secretary on the initiative. We understand that he had an unavoidable conflict, though we appreciate you filling in for him.

Mr. ARROWSMITH. Much of his prepared testimony has been covered by previous speakers.

The CHAIRMAN. Yes. If you could summarize, that would be great.

Mr. ARROWSMITH. I think I can best contribute by restricting, focusing, my comments on the Washington State TechNet computer system.

I will commit his full testimony into the record.

The CHAIRMAN. Without objection, we will submit his full testimony in the record. It is quite extensive, with many charts, which will be put in the record also.

Mr. ARROWSMITH. OK, thank you.

Even though it is called a computer network, that is only a minor ingredient of the project. To establish this network in the State of Washington, we had to find a facility to put it, funding, select the computers, gather the data, input the data, maintain the integrity and timeliness of the data, promote it, such that the community at-large knows that it is there.

The process within the State thus far has gone like this. We selected the Resource Center for the Handicapped, which is a local,

high-technology rehabilitation facility that is supported broadly by the corporate community around Seattle. The RCH teaches computer programming and electronic technology. It was a natural place to put the computer, because it gave us the handicapped ingredient, and a feeder system of employees such as Mr. Cusworth, who is with me. Tom is a graduate of our computer school and is one of the analysts on the program.

The CHAIRMAN. We are happy to have you with us.

Mr. CUSWORTH. Thank you.

Mr. ARROWSMITH. We selected a computer which is a time-sharing computer which is such that we can have remote access from different points around the State via phone line. We have started with the SCHSIS model, previously mentioned by Senator Thurmond of South Carolina, which is a referral system. They did the taxonomy or the organization of how you classify different types of services for the handicapped. And so far in the State, we have about 2,700 entries of entities of one kind or another that provide service for the handicapped. These can be Federal, city, State, agencies—churches, Kiwanis clubs, service clubs, things like that. In addition to the referral data base, we have added an equipment exchange, which is something like the newspaper want-ads for equipment to be donated, sold, or exchanged. This could be vans, wheelchairs, et cetera. We have constructed a bibliographic data base of about 1,000 entries of reports and periodicals. And we have a talent registry of able-bodied people who call in and say they want to do something for the handicapped—for instance, a carpenter that wants to work on a Sunday afternoon to build ramps, or something like that.

We are constructing the software in such a way that it can be standardized and propagated and cloned, if you will, into other States, without other States having to go through all of the computer development. We anticipate the process will go like this—that we will start a backbone network, move it into the States of Kansas, Massachusetts, Texas, and Pennsylvania—I believe our initial plan calls for—understand the problems of interstate communication and the requirements of traffic and how we are going to technically accomplish this during 1986. And then, from that backbone network, we will start folding in all the rest of the States into a national technical communications network.

The way it interacts with some of the other things that have been mentioned today, like the Tech Teams, in one negative way, we anticipate that if we are getting a lot of calls for a certain type of service within the State that we cannot satisfy, that are not on our data base, we can turn this over to one of the Tech Teams for further attention and development.

The CHAIRMAN. Well, thank you so much, Mr. Arrowsmith. We really appreciate that testimony. It is exciting testimony, and we are happy to have you with us as well, Mr. Cusworth.

Mr. CUSWORTH. Thank you.

[The prepared statement of Mr. Pierce follows:]

Senate Committee on
Labor and Human Resources
Sen. Orrin G. Hatch
Chairman

Hearing on Technology and the Disabled

December 4, 1985

Testimony

J. B. L. Pierce—Concepts for Independent Living

MR. CHAIRMAN, THANK YOU FOR THE OPPORTUNITY TO TESTIFY TODAY. MY NAME IS JACK PIERCE. I AM CHAIRMAN OF CONCEPTS FOR INDEPENDENT LIVING – A WASHINGTON STATE BASED NON-PROFIT CORPORATION. CONCEPTS IS RESPONSIBLE FOR THE EXECUTION OF A PROGRAM CALLED–PSI-TECH; WHICH STANDS FOR PRIVATE SECTOR INITIATIVE FOR TECHNOLOGY ENLISTED TO CONQUER HANDICAPS. THE PROGRAM WAS CONCEIVED BY CONCEPTS BASED ON THE NEED TO RESPOND TO A NATIONAL GOAL ESTABLISHED BY THE PRESIDENT IN NOVEMBER 1983.

P rivate
S ector
I nitiative for
T echnology
E nlisted to
C onquer
H andicaps

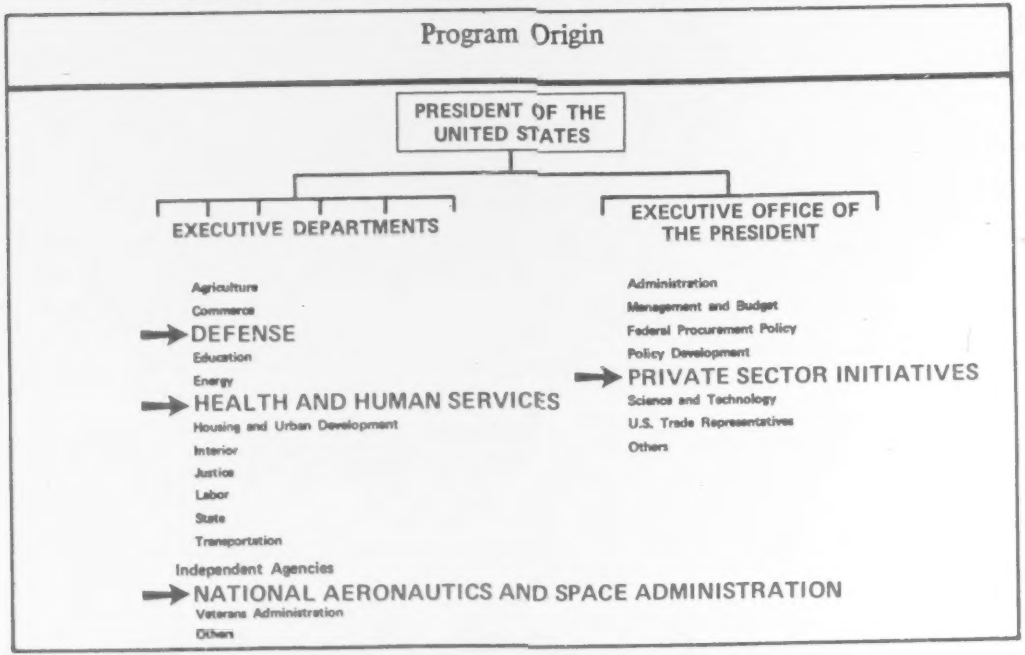
". . . Today I'm establishing a clear national goal. . . and let us begin today. . .

. . . We are putting together a national information and referral system. The handicapped. . .need to be able to cut through the maze of public and private services and gain timely access to information and programs. This new network, managed by the private sector, will provide this badly needed service."

President Reagan
November 28, 1983

CONCEPTS

A PROPOSAL WAS ADVANCED TO THE SEC HHS THAT CONCEPTS MOBILIZE THE RESOURCES OF THE HI-TECH INDUSTRIAL BASE--STARTING WITH THE SPACE/DEFENSE INDUSTRY--TO DEVELOP THREE PROJECTS. THE SEC HHS ASSUMED LEADERSHIP AND TOOK THE LEAD IN COORDINATION WITH THE OFFICE OF PRIVATE SECTOR INITIATIVES (THE WHITE HOUSE), THE DEPARTMENT OF DEFENSE, NASA AND THE PRIVATE HI-TECH INDUSTRIAL BASE.



CONCEPTS

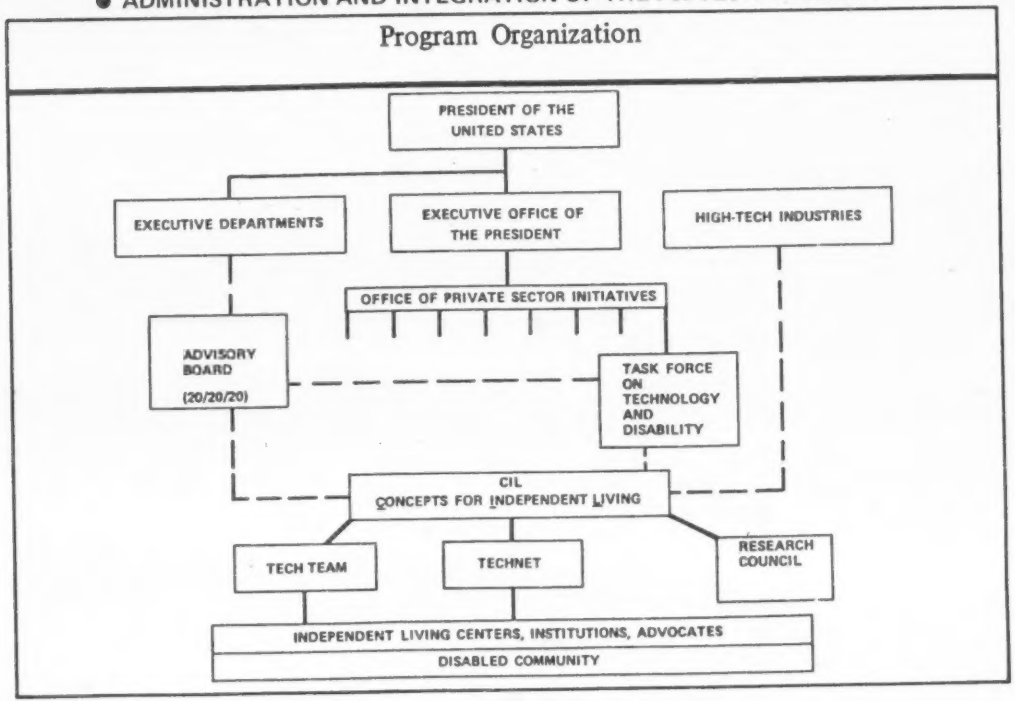
THE SEC HHS ESTABLISHED AN INTERNAL DEPARTMENT TASK FORCE ON TECHNOLOGY AND DISABILITY. THIS TASK FORCE REVIEWED AND ASSISTED IN REVISION OF THE PSI-TECH PROGRAM.

IN ADDITION, AN ADVISORY BOARD IS CREATED CONSISTING OF PRIVATE AND PUBLIC SECTOR CITIZENS FROM BUSINESS, THE DISABLED–LEGISLATIVE–AND OTHER COMMUNITIES–TO PROVIDE COUNSEL FOR CONCEPTS IN THE EXECUTION OF THE PROGRAM.

- Members of Congress
- Executive Branch
- Disability Community
- Business Representatives
- Academic Representatives
- Etc.

CONCEPTS' ROLE IS THAT OF NATIONAL SYSTEMS INTEGRATOR. CONCEPTS' FUNCTIONS ARE:

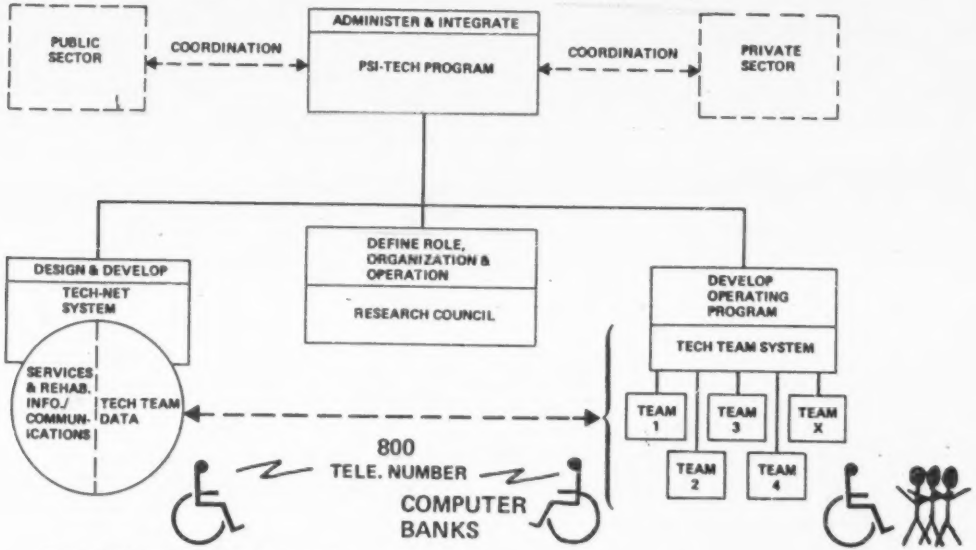
- MOBILIZATION OF PRIVATE SECTOR RESOURCES (FUNDING, PEOPLE, ETC.)
- ADMINISTRATION AND INTEGRATION OF THE PSI-TECH PROGRAM



CONCEPTS

THE PSI-TECH PROGRAM HAS THREE BASIC PROJECTS. THE DESIGN, DEVELOPMENT, TESTING AND IMPLEMENTATION OF:

- TECH-NET–A DATA BASE INFORMATIONAL RETRIEVAL SYSTEM AND COMMUNICATION NETWORK EMPLOYING THE HANDICAPPED, THEMSELVES, TO OPERATE THESE SYSTEMS WITH THE SUPPORT OF TOLL-FREE 800 TELEPHONE NUMBERS INTERFACED WITH A UNIFORM COMPUTERIZED DATA SYSTEM WHICH COULD BE TIED TOGETHER ON A NATIONAL NETWORK.
- TECH TEAM–THE CREATION OF A VOLUNTARY GROUP OF PEOPLE EMPLOYED IN THE HI-TECH INDUSTRIAL BASE––EXPERTS IN VARIOUS DISCIPLINES––TO WORK DIRECTLY WITH THE HANDICAPPED CITIZENS AND THEIR SUPPORT ORGANIZATIONS TO WORK PROBLEMS TOGETHER.
- RESEARCH COUNCIL–THE ORGANIZATION OF A GROUP WHICH WOULD REVIEW AND ADVISE CONCEPTS AS THE TECH-NET AND TECH TEAMS BECAME OPERATIONAL. THE RESEARCH COUNCIL WOULD BE FORMED ON A NATIONAL BASIS.

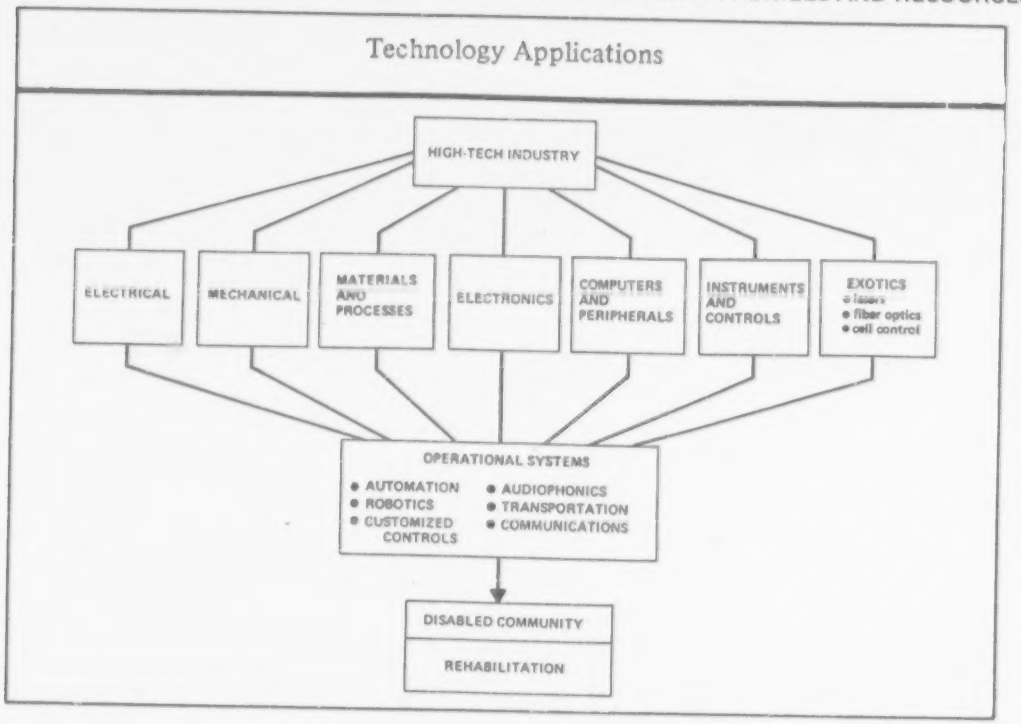


Operated by the handicapped
for the handicapped

CONCEPTS IDENTIFIED THE SPACE/DEFENSE INDUSTRY AS THE CORE SECTOR TO BEGIN MOBILIZATION OF ALL HIGH-TECHNOLOGY INDUSTRIAL BASE RESOURCES TOWARD EXECUTION OF PSI-TECH. WHY WAS THE SPACE/DEFENSE INDUSTRY CHOSEN?

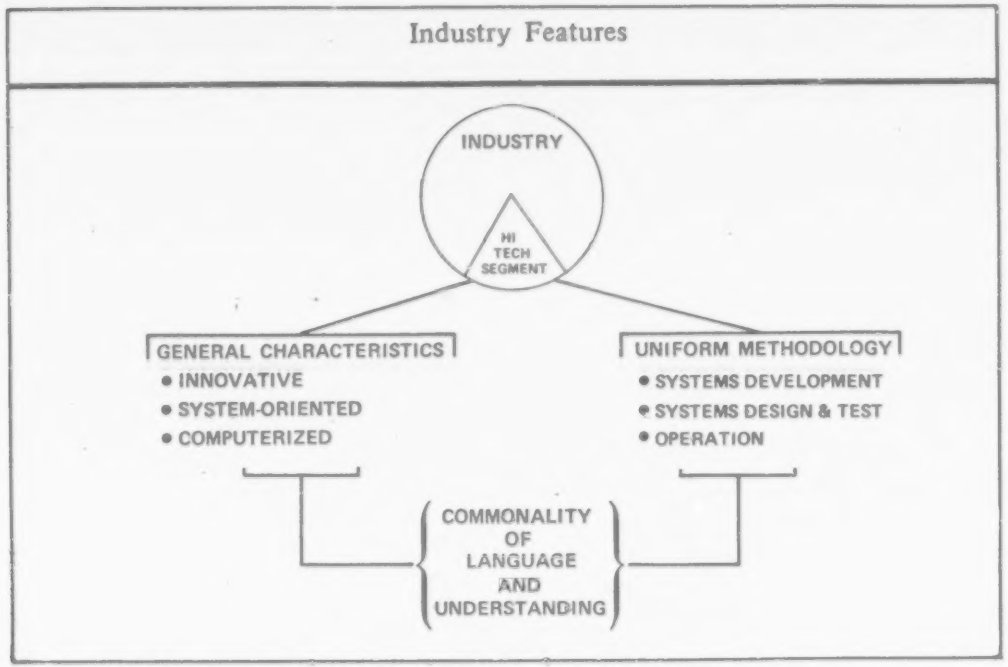
CONCEPTS

AFTER MOBILIZATION OF THE SPACE/DEFENSE INDUSTRY, THE ENTIRE SPECTRUM OF THE U.S. HI-TECH INDUSTRIAL BASE WILL BE MOBILIZED. THEN IT WILL BE POSSIBLE TO PROVIDE THE RESOURCES NECESSARY TO EXECUTE THE PSI-TECH PROGRAM ON A NATIONAL BASIS. THIS INDUSTRIAL BASE HAS THE NECESSARY SKILLS AND RESOURCES.



59-304 O - 86 - 3

THE COMMON FEATURE OF THE HIGH-TECH INDUSTRIAL BASE IS THE USE OF SYSTEMS-ENGINEERING METHODOLOGY TO SOLVE HIGHLY COMPLEX ORGANIZATIONAL AND TECHNICAL PROGRAMS.



CONCEPTS

IN JANUARY, A JOINT LETTER WAS SENT TO CHIEF EXECUTIVE OFFICERS OF MAJOR SPACE/DEFENSE AND HIGH TECHNOLOGY CORPORATIONS--TOGETHER WITH A VIDEO TAPE--WHICH OUTLINED TO NATURE OF THE PRIVATE SECTOR INITIATIVE. THE LETTER WAS SIGNED JOINTLY BY SECRETARY HECKLER, SECRETARY WEINBERGER AND ADMINISTRATOR OF NASA--JAMES BEGGS.

Notification to Key CEO's

THE WHITE HOUSE
WASHINGTON

Dear

President Reagan has proclaimed the ten years, 1983-1992, as the Decade of the Disabled. The President's intention is to enhance the quality of life for individuals with disabilities, and expand their productive capacity in the work environment.

The Federal Government has a long-standing commitment to people with disabilities. Consistent with this commitment, we are now establishing a public-private sector initiative on Technology and the Disabled. Members of Congress, the Executive Branch, private corporations, the professional and academic community and outstanding individuals will be invited to participate in this initiative. We are extending our personal invitation for you to join this important and prestigious group which will serve to heighten the visibility of this important national effort. A video cassette is enclosed which fully explains this program.

The need for such a public-private sector initiative is apparent. A large part of the population, some estimated 35 million Americans, have physical, developmental, mental or emotional disabilities. The United States enjoys a highly advanced industrial base with technical, managerial and human resources which can be marshaled to improve the quality of life for these Americans. Yet, a significant gap exists between the development of technology and its application to the needs of people with disabling conditions. The purpose of our public-private sector initiative is to help bridge that gap.

Concepts for Independent Living, a 501(c)(3) qualified, private, tax-exempt organization has been selected to assist in the administration of this program. They will be contacting you in the near future.

Our combined personal commitment, as reflected in the video, is vital to the success of this initiative. Together, we can make a difference. As a leader in technology, you can improve the quality of life for millions of Americans with disabilities. We look forward to your participation in this exciting and challenging initiative during the Decade of the Disabled.

Sincerely,

James M. Beggs
Administrator, NASA

Margaret M. Heckler
Secretary of Health and Human Services

Caspar W. Weinberger
Secretary of Defense

CONCEPTS

THE RESPONSE WAS MIXED. THEREFORE, IN MARCH OF '85 A PRESENTATION WAS MADE AT THE ANNUAL BOARD OF GOVERNORS' MEETING IN WILLIAMSBURG TO THE AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA BY SECRETARY HECKLER AND CONCEPTS. SUBSEQUENTLY, FURTHER MEETINGS WITH SENIOR OFFICERS OF THE SPACE/DEFENSE INDUSTRY WERE MADE TO BRIEF THEM ABOUT PSI-TECH.

TO AUGMENT THE FUNDING EFFORT, A COALITION—AN AD HOC GROUP—OF SENIOR EXECUTIVES FROM THE SPACE/DEFENSE INDUSTRY WAS FORMED UNDER THE VERY ABLE LEADERSHIP OF BOB KIRK, PRESIDENT AND CHIEF EXECUTIVE OFFICER OF THE LTV AEROSPACE AND DEFENSE COMPANY. SINCE THAT TIME, AND AFTER SPECIAL EFFORT BY BOB KIRK, THE FUNDING OF PSI-TECH PROGRAM BEGAN TO PICK UP. CONCEPTS WAS ABLE TO FUND THE INITIAL PRE-IMPLEMENTATION PROGRAM.

Coalition of High Technology Industries for the Disabled

Chairman: Robert L. Kirk; President; LTV Aerospace and Defense Company

Executive Committee Members:

- Robert Anderson
  Chairman and CEO
  Rockwell International
- Roy A. Anderson
  Chairman and CEO
  Lockheed Corporations
- Jack L. Heckel
  Chairman
  Aerojet General
- D. Brainerd Holmes
  President
  Raytheon Corporation
- Robert L. Kirk, Chairman
  President and CEO
  LTV Aerospace and Defense Company
- Charles S. Locke
  Chairman
  Morton Thiokol, Inc.
- Thomas G. Pownall
  Chairman and CEO
  Martin Marietta
- Roger G. Smith
  Chairman and CEO
  General Motors Corporation
- Malcolm T. Stamper
  Vice Chairman
  The Boeing Company
- T. J. Murrin
  President
  Energy and Advanced Technology Group
  Westinghouse Electric Corporation

BY DECEMBER, CONCEPTS HAD RECEIVED FUNDING IN THE AMOUNT OF $216,000 CASH. . . AS WELL AS ADDITIONAL SUPPORT FROM BOEING, IBM, SYNTREX CORPORATION, AND CONTROL DATA FOR "IN-KIND" CONTRIBUTIONS.

PSI-TECH Program 1985 Funding Sources (at December 1, 1983)

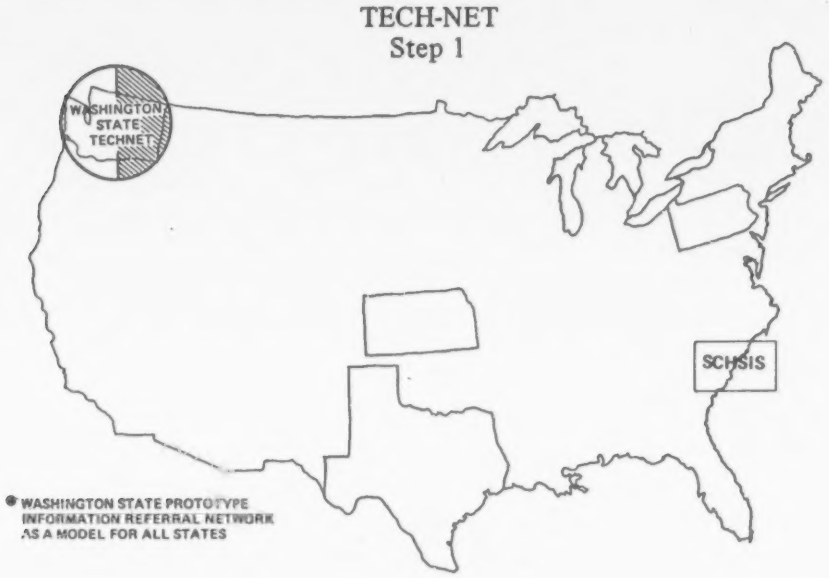
DATE	CONTRIBUTOR	AMOUNT	TOTAL TO DATE
12/19/84	Boeing	$ 8,200	$ 8,200
1/28/85	NAMES	5,000	13,200
2/25/85	Boeing	25,000	38,200
3/08/85	Avco	2,500	40,700
4/05/85	Rockwell	25,000	65,700
4/26/85	Morton Thiokol	10,000	75,700
7/03/85	Boeing	50,000	125,700
7/24/85	Burlington Northern	7,500	133,200
8/19/85	Archibald	2,500	135,700
9/16/85	IBM	25,000	160,700
9/26/85	ROHR Industries	5,000	165,700
10/03/85	Zachary Fisher	5,000	170,700
10/31/85	LTV Aerospace	33,333	204,033
11/01/85	Teledyne CAE	12,500	216,533

* Does not include major in-kind contributions from:
Boeing (Loaned personnel, facilities: $80,000)
IBM (Loaned personnel: $75,000)
Syntrex (Polaris Word Processing System: $40,000)
Control Data (Access to LOGIN System: $500)

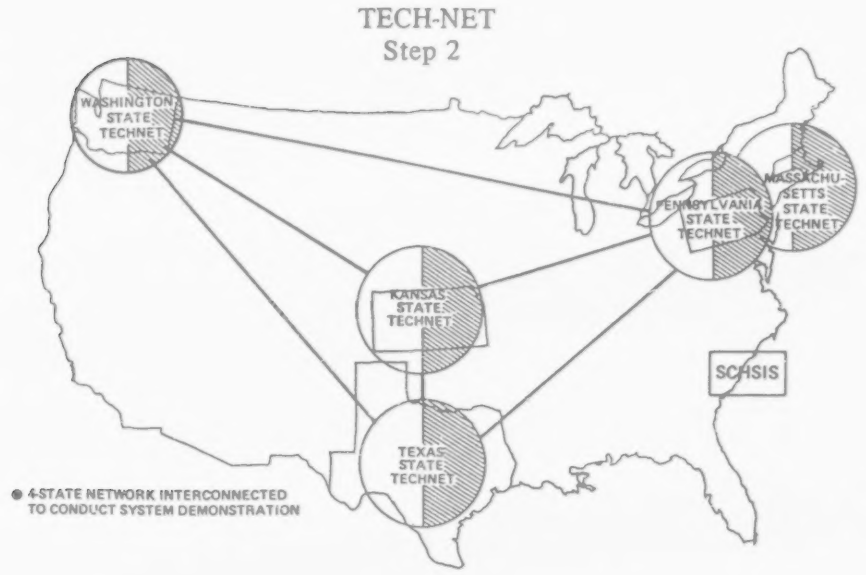
WHAT HAS CONCEPTS ACCOMPLISHED IN 1985--BEYOND THE INITIAL DESIGN OF PHASE I?

- TECH-NET TEST SITE

  DURING 1985, USING AN ORIGINAL SOUTH CAROLINA PILOT PROGRAM FUNDED BY HHS(SCHSIS--SOUTH CAROLINA HANDICAP INFORMATION SYSTEM), WE EXECUTED A "TEST SITE" TECH-NET PROJECT IN WASHINGTON STATE (RCH--RESOURCE CENTER FOR THE HANDICAPPED IN SEATTLE). AT RCH, A TOLL-FREE 800 TELEPHONE NUMBER SYSTEM, USING AN IMPROVED COMPUTER-BASED INFORMATION/COMMUNICATION SYSTEM, BECAME OPERATIONAL IN SEPTEMBER.


TECH-NET
Step 1
WASHINGTON STATE TECHNET
SCHSIS
● WASHINGTON STATE PROTOTYPE INFORMATION REFERRAL NETWORK AS A MODEL FOR ALL STATES

THE TECH-NET SYSTEM WILL BE EXPANDED TO INCLUDE 4 OTHER STATES IN 1986. PRELIMINARY PLANNING IS TAKING PLACE IN KANSAS AND MASSACHUSETTS. VARIOUS SUPPORT "SOFTWARE" MATERIAL IS BEING ASSEMBLED SO A UNIFORM COMMUNICATION/INFORMATION SYSTEM WILL BE DEVELOPED. . . AND THESE STATES CAN LINK UP FOR THE PRELIMINARY MODEL OF A NATIONAL TECH-NET.



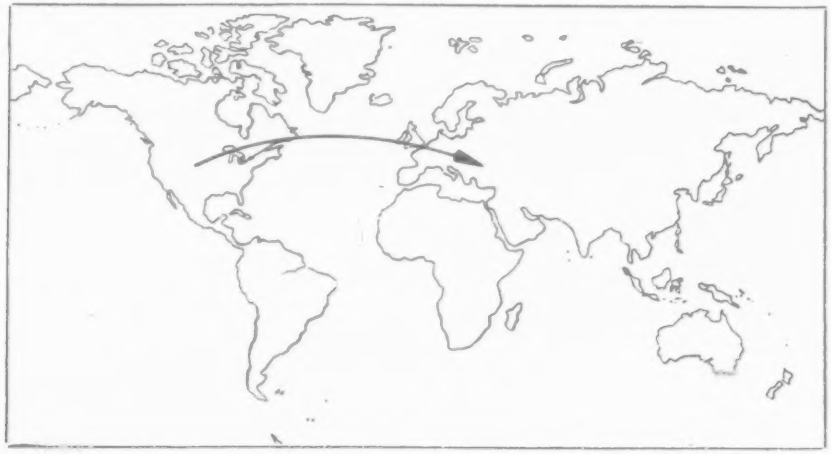
THE 4 STATE NETWORK WILL BE DESIGNED. . .DEVELOPED. . . TESTED. . .
AND THEN IMPLEMENTED INTO THE NATIONAL TECH-NET.

Technet–50 State Plan
Step 3 of the Integration

● 50-STATE IMPLEMENTATION FOLLOWS 4-STATE FEASIBILITY DEMONSTRATION

(INCLUDES ALASKA AND HAWAII)

THERE IS ALSO AN INTERNATIONAL FLAVOR TO TECH-NET. THE EUROPEANS HAVE ESTABLSIHED ALREADY A PROGRAM CALLED HANDYNET WHICH IS SPONSORED BY THE EEC IN BRUSSELS. CONCEPTS' TECH-NET WILL INTERCHANGE VALUABLE DATA WITH INTERNATIONAL ORGANIZATIONS. . . AND TO MOBILIZE RESOURCES ABROAD.



IN 1985–CONCEPTS' OPERATIONS CENTER ALSO ACCOMPLISHED THE FOLLOWING TASKS:

(1) TECH-NET SOFTWARE PACKAGE–THE DESIGN AND DEVELOPMENT OF A "SOFTWARE" PACKAGE TO BE USED TO TRAIN THE HANDICAPPED TO OPERATE THE TECH-NET SYSTEM(S) IN EACH STATE. THIS SYSTEM IS BASED ON THE EXPERIENCE GAINED AT THE RESOURCE CENTER FOR THE HANDICAPPED IN SEATTLE. . . AS A PRACTICAL "TEST SITE".

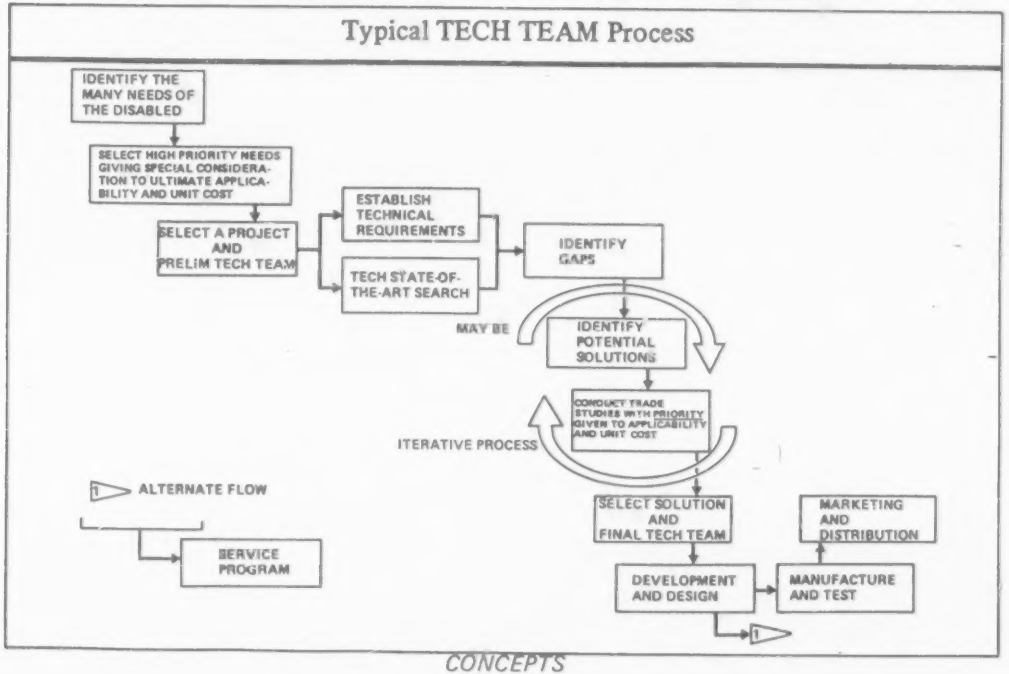
PSI-TECH Program–Products

- 1-State prototype TECH-NET demonstration
- Specifications: software compatibility of 50-state TECH-NET systems
- Specifications: compatibility of software
- Operating manuals
- Replicating instructions
- Site preparation instructions
- Data gathering instructions
- Training manuals
- Evaluation plan for system effectiveness

TECH-NET Centers:
Operated by/for
the Handicapped

(2) TECH TEAM PACKAGE–WE ARE ALSO WORKING ON TECH TEAM, WHICH DEPENDS UPON TECH-NET BEING OPERATIONAL. WE ARE DEVELOPING A PROJECT DESIGN BASED UPON PRACTICAL EXPERIENCE GAINED BY GROUPS SUCH AS:

- VME (VOLUNTEERS FOR MEDICAL ENGINEERING)–A WESTINGHOUSE SPONSORED PROGRAM
- SHARE (MASSACHUSETTS)–A GENERAL DYNAMICS PROJECT


Typical TECH TEAM Process
IDENTIFY THE MANY NEEDS OF THE DISABLED
SELECT HIGH PRIORITY NEEDS GIVING SPECIAL CONSIDERATION TO ULTIMATE APPLICABILITY AND UNIT COST
SELECT A PROJECT AND PRELIM TECH TEAM
ESTABLISH TECHNICAL REQUIREMENTS
TECH STATE-OF-THE-ART SEARCH
IDENTIFY GAPS
MAY BE
IDENTIFY POTENTIAL SOLUTIONS
CONDUCT TRADE STUDIES WITH PRIORITY GIVEN TO APPLICABILITY AND UNIT COST
ITERATIVE PROCESS
ALTERNATE FLOW
SERVICE PROGRAM
SELECT SOLUTION AND FINAL TECH TEAM
MARKETING AND DISTRIBUTION
DEVELOPMENT AND DESIGN
MANUFACTURE AND TEST

CONCEPTS

(3) INVENTORY CHECKLIST—CONCEPTS DESIGNED—AND DISTRIBUTED AN INVENTORY CHECKLIST FOR THE SPACE/DEFENSE INDUSTRY. THE CHECKLIST WILL PROVIDE INFORMATION ABOUT ALL CURRENT PROGRAMS BEING SUPPORTED BY THE INDUSTRY FOR DISABLED CITIZENS.

CONCEPTS

WHAT ARE THE ACTION(S) TO TAKE PLACE IN 1986?

- ESTABLISH A NATIONAL SITE IN WASHINGTON, D.C.
- TECH-NET INSTALLATION–KANSAS
- TECH-NET PRE-IMPLEMENTATION–TEXAS, PENNSYLVANIA AND MASSACHUSETTS
- IMPLEMENT THE FIRST TECH TEAM PROJECTS
- PREPARE THE OPERATING PLAN FOR THE RESEARCH COUNCIL

The CHAIRMAN. Professor Cory, let us turn to you.

Professor CORY. Thank you, Mr. Chairman.

I will summarize the testimony which has been previously submitted for the record.

I am deeply honored to be with you this morning to talk to you about the work being done by a unique organization for the benefit of people who are profoundly disabled.

The SHARE Foundation in North Dartmouth, MA, is a nonprofit corporation staffed by volunteers, most of whom are from the Electrical and Computer Engineering Department at Southeastern Massachusetts University. We have no paid staff.

Since our inception in 1981, we have logged nearly 20,000 volunteer hours to benefit about 50 severely disabled individuals.

Our primary purpose is to provide communications rehabilitation services and equipment to disabled people who are unable to communicate independently. The majority of our clients are more profoundly disabled than any that you have heard described to you this morning.

Typical of our clients is Ms. Linda Texceira, who has been featured extensively in the media, both locally and nationally. Linda has normal hearing, vision, and intelligence, but cerebral palsy has deprived her of the ability to walk, to use her hands, and to speak. Since she cannot hold a pencil or operate a typewriter, and since she is physically unable to gesture or to make meaningful sounds, her communication with her family was limited to nodding her head and moving her eyes.

Today, with modern computerized equipment designed and produced by SHARE Foundation volunteers and paid for by concerned individuals in Rhode Island, Linda can actually speak by means of an electronic voice synthesizer; she can write letters, she can turn on her radio and tape player; she can even use the telephone.

Linda's world has changed dramatically since modern technology and traditional volunteerism were brought to play to enable her to communicate. Today, Linda is very much in demand as a guest speaker and panelist. In 1984, she received a citation from President Reagan for her volunteer activities with and in behalf of disabled people.

Linda is only 1 of about 50 individuals we have helped. Thirty others are now on an active waiting list. Nationwide, there are tens of thousands more nonvocal children and adults who could be helped—possibly, as many as a million.

Many of our clients are afflicted with Amyotrophic Lateral Sclerosis, better known as ALS or Lou Gehrig's Disease. This is the disease with which former Senator Jacob Javits is afflicted. ALS has left one of our clients totally paralyzed from the neck down and unable to move anything except his eyes, eyelids, and eyebrows. He is fed intravenously and breathes with the aid of a respirator. Only his hearing, vision, and thinking mechanisms are intact. A well-educated and prominent individual, his intelligence level is the same as yours and mine, but he is totally unable to communicate even his most basic of wants and needs. He is a virtual prisoner within his own body.

Through the work of the SHARE Foundation, he and several others similarly afflicated with ALS are able to communicate inde-

pendently by means of specially devised talking computers which operate under the control of a person's raised and lowered eyebrows. His respirator, he tells me, keeps his body alive; his communicator, he tells me, gives him a reason to live.

No two of our clients have received identical equipment. There is no off-the-shelf solution to the problems of the communicatively disabled. One size may fit many, but for thousands of nonvocal Americans, solutions will only be found on a one-on-one basis. The users themselves must specify what the hardware is to do and how it must do it.

The average system costs about $2,000 for parts and may require 500 hours or more to design and build. Follow-on services may require hundreds of additional hours. Profoundly disabled individuals, especially those sustained by respirators, cannot travel any great distance with ease. As a consequence, rehabilitation services need to be available on a very local basis. What is needed is a good marriage of public and private sector initiatives to establish local rehabilitation centers. There needs to be a formal mechanism for information interchange, and there needs to be a formal mechanism for funding at least the overhead portion of each center's financial needs.

Organizations such as SHARE can supply the 1-on-1 contact but such organizations will not automatically spring up where they are needed, and neither will they exist long in isolation. Volunteers, however well-intentioned and however well-motivated will burn out, as ours are in danger of doing if they are not properly nurtured and supported.

Because of our dramatic successes, we are deluged with requests for help from across the country and around the world. This success threatens our very existence. Only through the active support and encouragement of volunteer groups by the private sector and a similar backing by the public sector will volunteerism yield its greatest return and will volunteer organizations survive.

Thank you, Mr. Chairman.

[The prepared statement of Professor Cory and responses to questions submitted by Senator Kerry follow:]

TESTIMONY OF

PROF. LESTER W. CORY*

Testifying on

"SPACE TECHNOLOGIES AND HUMAN RESOURCES"

before

THE UNITED STATES SENATE COMMITTEE

on

LABOR AND HUMAN RESOURCES

WASHINGTON, D.C.

December 4, 1985

* Co-founder and President
Society for Human Advancement
through Rehabilitation Engineering
Foundation, Inc. (SHARE)

c/o Southeastern Massachusetts University
North Dartmouth, MA 02747
(617) 999-8482

59-304 O 86 - 4

Thank you, Mr. Chairman. I am deeply honored to be here this morning to talk with you about the work being done by a unique organization for the benefit of people who are profoundly disabled.

The SHARE Foundation in North Dartmouth, Massachusetts is a non profit corporation staffed by volunteers most of whom are from the electrical and computer engineering department at Southeastern Massachusetts University. Since our inception in 1981 we have logged nearly 20,000 volunteer hours and raised more than $50,000 to benefit about 50 severely disabled individuals.

The primary purpose of SHARE is to provide communications rehabilitation services and equipment to disabled people who are unable to communicate independently.

Our first client was Miss Linda Texceira of Little Compton, Rhode Island who has been featured extensively in the media both locally and nationally. Linda has normal hearing, vision and intelligence, but Cerebral Palsy has deprived her of the ability to walk, to use her hands and to speak. Since she cannot hold a pencil or operate a typewriter, and since she is physically unable to gesture or to make meaningful sounds, her communication with her family was limited to nodding her head and moving her eyes.

Today, with modern computerized equipment designed and produced by SHARE Foundation volunteers, and paid for by concerned individuals in Rhode Island, Linda can not only speak by means of an electronic voice synthesizer, but she can also write letters, she can turn her radio and tape player on and off, and she can even use the telephone. Linda's world has changed dramatically since modern technology and traditional volunteerism were brought to play to enable her to communicate. Today, Linda is very much in demand as a guest speaker and panelist. In 1984, she received a citation from President Reagan for her activities with and in behalf of disabled people. Now she is being tutored by a volunteer teacher. Her hope is to eventually earn a high school diploma, an opportunity which was denied to her during her formative years because she was unable to communicate.

Linda is only one of the more than 50 individuals we have helped. Thirty others are now on a waiting list. Nationwide, there are tens of thousands more nonvocal children and adults who could be helped - possibly as many as a million.

Many of our clients are afflicted with Amyotrophic Lateral Sclerosis, better known as ALS or Lou Gehrig's Disease. This is the disease with which former Senator Jacob Javits is afflicted.

ALS has left one of our clients totally paralyzed from the neck down, and unable to move anything except his eyes, eyelids, and eyebrows. He is fed intravenously and breathes with the aid of a respirator. Only his hearing, vision and thinking mechanisms are intact.

A well educated and prominent individual, he is still able to think profound thoughts, but is totally unable to communicate even his most basic of wants, needs and fears. He is a virtual prisoner within his own body.

Through the work of the SHARE Foudation, he and several others, similarly afflicted with ALS, are able to communicate independently by means of specially devised talking computers which operate under the control of a person's raised and lowered eyebrow.

A 13 year old in Warwick R.I. is paralyzed from the neck down as a result of a hit and run auto accident. Sipping on a hollow tube resembling a drinking straw enables him to control a SHARE built typewriter. By whistling, he can turn his stereo on and off and control his tape player, his T.V. set and the lights in his room. A special infrared joystick having no moving parts enables him to play video games with a fair chance of outscoring his able bodied opponents.

A point to be emphasized is that to date no two of our clients have received identical equipment. There is no "off the shelf" solution to the problems of the communicatively disabled. One size may fit many, but for thousands of nonvocal Americans, solutions will only be found on a one on one basis. The users themselves must specify what the hardware is to do and how it must do it.

Even today, profoundly disabled individuals, especially those sustained by respirators, cannot travel any great distance with ease. As a consequence, rehabilitation services need to be available on a very local basis.

What is needed is a good marriage of public and private sector initiatives to establish local rehabilitation centers across the nation. There needs to be a formal mechanism for efficient information exchange among centers, and there needs to be a formal mechanism for funding at least the overhead portion of each center's financial needs.

Organizations such as SHARE can supply the one on one contact which is vital to the production of useful and efficient rehabilitation equipment and services. Such organizations, however, will not automatically spring up where they are needed. Neither will they exist long in isolation. Volunteers, however will intentioned and however well motivated, will burn out as ours are in danger of doing, if they are not properly nurtured and supported.

Only through the active support and encouragement of small volunteer groups by the private sector and a similar backing by the public sector will volunteerism yield its greatest return.

From Senator John Kerry
(Hearing on Applications of
Space Technology to Human Resources)

FOR PROFESSOR LESTER CORY:

(1) Where do you think funding resources in the application of technology to the disabled should be directed?

(2) If one or many volunteer engineers walked into your office tomorrow, would you be able to immediately use their talents? Please explain your answer.

(3) The efforts and activities of SHARE in Massachusetts have received a great deal of media attention. Has this attention brought you more technical volunteers from industry? What has been the nature of any interaction you have had with industry?

FOR PROFESSOR LESTER CORY:

(4) In what respects do you feel that SHARE has served as a prototype of the TECH-TEAM concept? How do you feel your experiences could be most usefully applied to the TECH-TEAM approach? Do you feel that prototype studies, similar to those for the TECH-NET are needed for TECH-TEAMS? What do you consider, given existing knowledge and experience, to be the best arrangement in which TECH-TEAMS might operate?

REPLIES TO SENATOR KERRY'S QUESTIONS:

1. Funding needs to be directed to those who will actually apply it to benefit the disabled population. We should be funding hardware and services rather than studies and surveys. In my opinion, we have spent a lot of money on research and development that didn't need to be spent. We have paid for prototypes that will never be produced.

   Preference in funding should be given to those who are in direct contact with real world problems and who can demonstrate that they have the ability to solve those problems in a practical way.

2. One, yes. Many, perhaps not. The problem is not lack of work. The problem is that I lack the full time support staff to coordinate the activities of more than a few additional volunteers. My experience has been that each project or group of projects needs a full time project coordinator. It takes a good deal of effort to bring a volunteer up to speed on a project. Sometimes it takes longer to indoctrinate a volunteer than it would take to do the job yourself. You hope that the indoctrination will pay off on the next project. Sometimes it does.

   One would think that volunteers could direct their own activities. This seldom works. For one thing, volunteers working on the same project may never see each other because they either don't work at the same time or they don't work at the same place. A good deal of our volunteer work is done on weekends or in the wee hours of the morning. Someone needs to be on the job during working hours to do such things as purchase supplies and handle requests for service. Volunteers tend to come and go on their own schedule. To be able to productively utilize more volunteers, I first need some full time staff.

   I should add, however, that in terms of demand for services, I have enough now to keep a dozen workers busy for the next year. If I went looking for work (which I don't), there is no end to the projects we could take on.

3. The attention we have received in the media has never brought us anything except more requests for help. I shudder each time one of our clients is featured, because the result is invariably an onslaught of new requests, many of which will be outside of our field, but all of which will take time to handle.

   Very few of our volunteers are from industry. Those who are, work for us on their own time, probably without the knowledge of their employers. Several companies have donated surplus supplies and equipment to SHARE, but none have volunteered any manpower. The only possible exception is that the local chapters of the Telephone Pioneers have taken on several projects for us and have turned in outstanding results. We have also taken projects from them in areas where we were better able to provide a given service.

4. Since we are doing what the TECH-TEAMS presumably will do, it would seem to make sense to look at us as a prototype. I am not certain that there is any other group or organization that more closely emulates the TECH-TEAM concept than SHARE does.

We would be pleased to share the details of our successes with other groups, but perhaps the details of our blunders would be more valuable. I think that our experiences could be most usefully applied by having us train some missionaries who would then help to set up TECH-TEAMS and also help to keep them going when they ran into problems. There were many times when SHARE needed help and didn't know where to turn. It took us two years and intervention from our congressman just to get squared away with the IRS as a non profit organization. Funding is a perpetual problem. Some funding schemes which looked very good were a big waste of time and vice versa. A lot of TECH-TEAMs will fold unless there is a place for them to go for advice and help. "START UP" people need to be available to help the TECH-TEAMS to organize. Left to chance there is no reason to expect that TECH-TEAMS will spring up where they are needed or that those that are started will survive.

As for prototype studies, I think that the TECH-TEAM concept demands a good deal more study than does TECH-NET since TECH-TEAM both involves more workers and is potentially a lot less standard. In consonance with my answer to your first question however, I would prefer to see any monies put aside for prototype study be used instead for prototype development, so that we may have something concrete to study.

Lastly, I think that the best arrangement for the operation of TECH-TEAMS is to center them at state universities. Aside from the fact that SHARE is at Southeastern Massachusetts University, there are other reasons why I make this suggestion.

First is the issue of real estate and access to equipment. SHARE has both at SMU, and we haven't (yet) been billed for either. Access to data, technological expertise, and public meeting facilities are also considerations. The two most important considerations however are access to students and the fact that the univertsity provides a neutral meeting ground for TECH-TEAM participants who may very well be high tech competitors in industry. SHARE more than pays its way at SMU by involving SMU's students from many disciplines in real world projects that have significant pedagogical value. The university also derives benefit from the favorable publicity concerning our work. It would be difficult to duplicate SHARE's operation in other than a university setting.

The CHAIRMAN. Well, thank you, Professor Cory. That is noble testimony, and we hope that this hearing will help you in that regard, and certainly, Secretary Heckler's initiative may be very helpful in the future.

Mr. Arrowsmith, let me ask you one question. After individual Tech Teams are established, how will the new technological applications be made available to disabled citizens with similar needs nationwide? Is there a mechanism in place to avoid duplication of effort by these teams?

Mr. ARROWSMITH. Well, it is not in place yet, but that is anticipated as one of our major goals, to maintain the status and plans of all the various Tech Teams throughout the entire national network so that they can share common knowledge and cut down on duplication.

The CHAIRMAN. Let me commend you for the work you are doing. We are really happy to have both of you here with us today.

Do you have any comments you would care to make today, Mr. Cusworth?

Mr. CUSWORTH. None, other than the point about further technology and the needs of the disabled. Like the gentleman on my left was saying, all this stuff is really needed, and a lot of it is really specialized and individualized things. Being from where we are, I think the private sector is able to get it done a lot more efficiently than having to go through the Government.

The CHAIRMAN. Thank you. What type of activity on the 800 toll-free line are you experiencing today, and how do you anticipate that it will grow?

Mr. CUSWORTH. We get about 20 calls a day now. Most of our calls are equipment-oriented, people looking for a communicator device, maybe looking for wheelchairs and various aids. That is what about 80 percent of our calls are, and the others are just general information that people are looking for.

And really, the more it gets publicized, and the more people hear about it, the more it is going to be used, and I think it is definitely a really good service. There is too much run-around that people have to go to to try to find what they are looking for, and this kind of eliminates it.

The CHAIRMAN. Well, thank you.

Professor Cory, let me commend you for the work that you have been doing. But where has most of the handicapped technology come from that SHARE is adapting to individuals with handicaps? Where is most of this technology coming from that you have been mentioning in your testimony?

Professor CORY. The majority of our volunteers are members of the faculty and staff at Southeastern Massachusetts University. We have also involved several dozen students.

Now, there are people who have come to us from area industry, but they come to us as individual volunteers on their own time. We have also had volunteers come to work for us from some of the Federal labs, both in Rhode Island and in Connecticut, but again, they came as individuals.

About 90 percent of our work has been done by a handful of engineers at Southeastern Massachusetts University.

THE FINAL PROJECT IS THE CREATION OF THE NATIONAL RESEARCH COUNCIL.

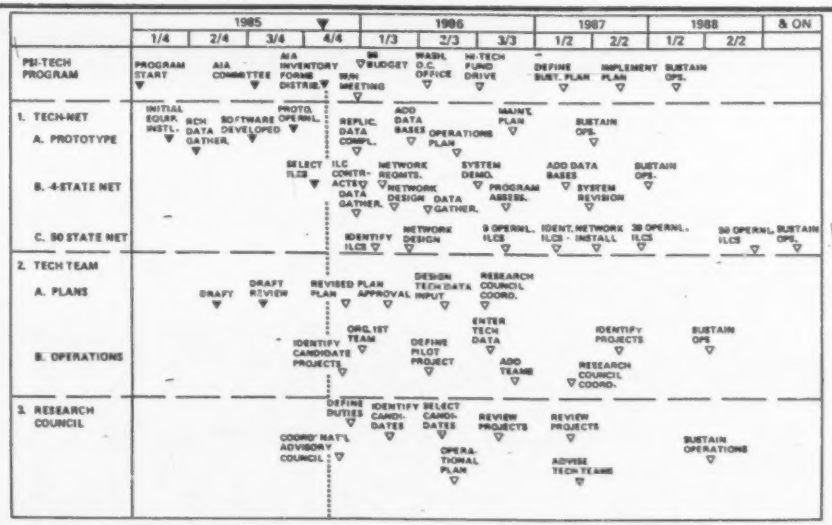
A panel of recognized experts to:

- Coordinate access to resources, facilities and research activities
- Identify applicable technology
- Input TECH-NET
- Advise TECH Teams

CONCEPTS—WITH LIMITED BUDGET—HAS ACCOMPLISHED MUCH. BUT MORE EFFORT AND RESOURCES WILL BE REQUIRED IN 1986. THE FUNDING PROGRAM IS ALWAYS THE PACING CONSTRAINT—TO MAINTAIN THE SCHEDULE ESTABLISHED. . .NAMELY, A FIFTY STATE OPERATION BY 1988 OF PSI-TECH PROGRAM. WE HOPE THE HIGH-TECHNOLOGY INDUSTRIAL BASE WILL RESPOND.

THANK YOU, AGAIN, FOR THE OPPORTUNITY TO TESTIFY.

PSI-TECH
Milestone Chart
1 November 1985



CONCEPTS

The CHAIRMAN. Well, thank you. This is inspirational testimony—all of it has been today—and I am grateful to have you people here on this panel.

Thank you for being with us. We appreciate it.

Mr. ARROWSMITH. Thank you, Mr. Chairman.

The CHAIRMAN. The next panel I will introduce is a very interesting panel as well. I might add, as the only current Senator from Utah who has not been in space, I am of course envious of our next witness who has. I would like to welcome Dr. Story Musgrave, a physician, a scientist, and an astronaut on the space shuttle.

Second, I would also like to welcome someone from closer to home, Dr. Royce Moser. Dr. Moser is now coordinator of the preventive medicine programs at the University of Utah and past Commander of the U.S. Air Force School of Aerospace Medicine. We welcome you to your new home in Utah, Dr. Moser, and we welcome you to this new home here in the committee. As long as I am chairman, it will be home to you; how is that?

Dr. MOSER. Thank you, sir.

The CHAIRMAN. Dr. Musgrave, we are very happy to have you with us as well, so we will begin with your testimony.

STATEMENT OF DR. F. STORY MUSGRAVE, ASTRONAUT, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION; AND DR. ROYCE MOSER, COORDINATOR, PREVENTIVE MEDICINE PROGRAMS, UNIVERSITY OF UTAH, AND PAST COMMANDER, U.S. AIR FORCE SCHOOL OF AEROSPACE MEDICINE AND IN CHARGE OF THE FIREFOX PROGRAM

Dr. MUSGRAVE. Thank you very much, Senator Hatch.

The wedding of NASA and NASA technology to helping the disabled historically began even before there was a Space Program.

The physiology of going into space is very similar to being disabled or being confined to bed. Even today when we study what is going to happen to ourselves when we go into space, we use the bedrest analog; the physiology and the science is very similar.

Way back, even before we went into space for the first time, the Space Program defined what the physiology and the biology of being in space was, and also what it was to be disabled or to be confined to bed. So the Space Program initiated the physiology and biology of being disabled.

Likewise in space, as Mr. Kirk said, we cannot survive in space by ourselves. We need life support systems just as the disabled do down here on Earth. There have been tremendous spinoffs in that area, like spacesuits. From spacesuits, we went to isolation garments, where people with immune deficiencies could live down here.

The spinoffs in terms of instrumentation and sophisticated sensors are very well known. Things such as effectors, like eyeball-driven things and like robotics, like prostheses, are also coming along. Very recently, we have been manufacturing pharmaceuticals in space much more efficiently than we can do down here, and also are manufacturing some pharmaceuticals in space which we cannot manufacture down here.

Even further along that state of the art is diagnosis or determination of some biochemicals, some drug structures in space by growing ultrapure crystals in space and then bringing them back down here to Earth.

But this is only the beginning. I think we are going to move out an awful lot faster from here on, I am very confident, because of this initiative of technology and the disabled, inspired and led by Secretary Heckler. What that is going to do is—the spinoffs in the past, a lot of them were through serendipity. We had certain technology and certain engineers working in the Space Program, and then we looked at how we might apply that somewhere else as an afterthought. But the real breakthrough in this initiative, the real way that what we are talking about here today is going to pay off, is that we are going to define the requirements of disabled people the same as the requirements of how you support astronauts in space; we are going to define those requirements and give those problems to engineers that are already in place.

But an even bigger way that this is going to pay off is through the publicity of the things we are doing today, you can put in the back of all these engineers and scientists—you can put in the back of their minds while you are working on this, always key yourself when you get done working that specific direct problem, how might I apply this somewhere else. That is the way we are going to be able to financially support this. The engineering is already in place, and the education of that person and the pay of that person and that technology is in place. But it is just in the back of your head as you are working, these other direct problems, and you would always ask yourself, how might I apply what I am doing at this minute to helping the disabled, or how might I apply this to this case here—you are going to have a tremendous creative effort because of the interdisciplinary nature. You are going to have people combining their talents, such as biology and chemistry, or physics and anthropometrics.

So I think we will get an awful lot done for the money invested in this technology, and also we are going to be an awful lot more creative in this way.

So it is through the initiative of Secretary Heckler and this particular body that these things are going to come into play.

[The prepared statement of Dr. Musgrave follows:]

Statement of

Dr. F. Story Musgrave
NASA Astronaut

National Aeronautics and Space Administration

Before the

Committee on Labor and Human Resources
United States Senate

Mr. Chairman and members of the committee:

Every citizen benefits directly from our national investment in space activities. NASA is particularly proud of the manner in which the technology of the aeronautics and space program is being applied to specific problems in medicine and physical rehabilitation. Our technology transfer process has contributed significantly to recent advances in the biomedical sciences. There have been more than 12,000 applications of space technology applied to medicine in various devices.

The NASA Technology Utilization Program, as it is structured today, has resulted from experimental programs and practical evolution. It has been in existence since 1963, and it consists of a small Headquarters staff that, among other things, manages programs at the NASA Field Centers and contractor facilities. Each NASA Field Center has a Technology Utilization Office that is staffed with experts in the art of transferring technology, and they provide technical assistance and disseminate information to other Federal agencies, State and local governments, and the private sector.

The following are a few examples from many of NASA technology that improve medical diagnostics and treatment, and devices to assist the disabled.

IMPROVED DIAGNOSTICS

Approximately 2 million Americans suffer serious burns each year. Of those hospitalized, 70,000 receive intensive care and 10-12 thousand patients die from their injuries. Modern treatment is based on early recognition and removal of dead tissue to reduce infection and hasten healing. Current methods for burn depth determination are inaccurate, cumbersome, or both. Burn depth diagnosis may be aided by NASA ultrasonic technology which may be used to map precisely and conveniently the depth of the interface between viable and dead tissue in burn injuries.

Advanced ultrasonic technology developed at Langley Research Center for the characterization of material is being applied to burn depth diagnosis in collaboration with the Medical College of Virginia, the U.S. Army Institute of Surgical Research, and the National Institute of General Medical Sciences.

The need for a Noninvasive Intracranial Pressure Monitor has been known for years. Excessive accumulation of fluid within the natural cavities of the brain may result in increased intracranial pressure (ICP), causing transient or permanent neurological dysfunction and even death. Increased ICP can be a complication of head injuries, tumors, central nervous system infection, hydrocephalus, and meningitis. Fifty thousand people each year who survive a serious head injury are left with an intellectual impairment which precludes their return to previous employment levels. The extent to which ICP is elevated is a critical factor in the selection of appropriate therapy. An estimated 300,000 ICP monitoring procedures are performed annually in the U.S., all requiring some degree of invasive procedure. Scientists at the NASA Langley Research Center have developed a concept utilizing state-of-the-art ultrasonic pulsed phase-locked loop technology to measure ICP noninvasively. The National Institute of Handicapped Research, the National Institute of Neurologic, Communicative Disorders and Stroke, and the University of Virginia are working with NASA to test the Langley concept. This device would allow more frequent, safe monitoring of ICP.

NEW OR IMPROVED TREATMENT

Corneal Topography is unique to opthalmology. This technique aids in correcting refractive errors, and repairing injury to the cornea of the eye and techniques depends on accurate measurements of the shape of the outer surface of the cornea. Current techniques do not permit the fast, high resolution measurements required before, during, and after surgery. NASA optics technology at Marshall Space Flight Center, used to gauge the surface of the space telescope mirror, is being applied to this problem. Optics and computer technologies from the Jet Propulsion Laboratory are also being applied to this problem. NASA, the National Eye Institute, and two small businesses are developing a corneal topography measuring system.

In cardiology, NASA technology has produced a real improvement in the lifestyle of the ill and handicapped. In the United States, diseases of the heart remain the leading cause of death. Each year, over 500,000 new heart attacks occur and approximately 450,000 people annually survive the first heart attack. Many of the fatal heart attacks result from a malfunction of the neuroelectric control system that regulates the periodic contraction of heart muscles. NASA joined with the

Johns Hopkins University, Applied Physics Laboratory, and industry to use hybrid electronics from NASA satellites, rechargeable battery technology and space age reliability and quality assurance to develop the first Implantable Rechargeable Pacemaker. The rechargeable aspect introduced a way to sidestep the problem of frequent recurrent surgery caused by battery failure every 18 months or so and allowed for a more efficient and energy conserving implantable device. The manufacturer continued to build on the aeronautics and space technology and has developed a miniaturized cardiac pacer that can be programmed to the patient's heart. This system uses two-way communications capability similar to that used to send coded instructions to unmanned satellites.

Currently, NASA is working with the medical community and industry to perfect an Automatic Implantable Defibrillator. This device is designed to detect and counter cardiac fibrillation, a situation wherein the heart suffers a wave of erratic contractions and does not pump blood. This device uses a low energy consumption microprocessor and a memory system to detect cardiac arrhythmias, discriminate between them, institute the appropriate corrective action, warn the patient, and record the episode.

Another system now being designed will automatically detect hypertension, or high blood pressure, and control the problem through continuous administration of medical agents. In the United States there are over 16 million people classified as having hypertension, representing about 14 percent of the work force. These people are at serious risk for heart attack and other diseases. For instance in 1980, the deaths of over 32,000 Americans were attributed either to hypertension or hypertensive heart disease. The device is called a Sensor Actuated Medication System and will be developed over the next 4 years.

NASA, working with the National Institutes of Health (NIH), Johns Hopkins University, and several businesses developed a Programmable Implantable Medication System (PIMS). A number of chronic diseases, such as diabetes, require long-term infusion or frequent injections of medication. Reliable control of blood sugar levels throughout a diabetic's life is thought to diminish the incidence of complication such as kidney disease, retinopathy, atherosclerosis, and heart attacks. An implantable, high-reliability infusion pump that could accurately deliver medicine at programmed rates improves control of blood sugar in diabetics and could be useful in other diseases such as leukemia, thalassemia, and hormone disorders. The PIMS incorporates safety features and reliable delivery rates required to insure safe medication levels. Space microcircuitry, reliability and quality assurance, microcomputer/digital integrated circuitry, pumping and valving systems from various aeronautical programs were used in developing this system.

Another project that was developed some years ago was the Human Tissue Stimulator. Chronic pain and involuntary motion disorders can often be treated effectively by electrical stimulation. Electric pulses are sent through wire leads to targeted nerve centers or specific areas of the brain. Early stimulating devices were not widely used because they required cumbersome, external power packs which had limited lifetimes. An implantable human tissue stimulator was developed by NASA and a small business in collaboration with the Applied Physics Laboratory of the Johns Hopkins University. This development effort resulted in a microminiaturized implantable system, roughly the size of a deck of a cards. It includes a tiny rechargeable battery, an antenna, and microelectronics to receive and process commands and to report on its own condition via telemetry. This device led to the commercialization of a Neural Pacer that is used today to treat several neural muscular disorders. NASA's satellite telemetry and command system technologies, and microelectronics were employed in this system.

ASSIST DEVICES

NASA is beginning a new project with the Veterans Administration and the National Institute of Handicapped Research (NIHR) to develop a Miniature Functional Electrical Stimulator. There are 645,000 paraplegics or quadraplegics in the United States and several laboratories have demonstrated that paraplegics could stand, ride bikes, and walk very, very slowly if a computer was used to provide the proper electrical stimulus to the muscles or nerves involved. The Veterans Administration (VA) has requested NASA assistance in the completion of the miniature stimulator and to insure reliability and quality assurance and to facilitate commercialization. At the same time, NIHR is planning to join NASA in the development of Advanced Sensors. These sensors will, hopefully, allow manufacturers to develop a "closed loop" system. Microelectronics, reliability and quality assurance, electronic packaging, and systems engineering are being applied to this device.

Approximately 700,000 people in the United States rely on wheelchairs for mobility. For these people, the commercial airplane is a major barrier. Standard wheelchairs are not compatible for use in airplanes, thus limiting access to the lavatory. Employment requiring extensive plane travel is most difficult. Stimulated by various organizations for the handicapped, the Rehabilitation Services Administration, and NIHR, NASA entered into a collaborative effort with the handicapped organizations and NIHR to develop a wheelchair designed for use in the airplane environment. The chair was designed for easy seat transfer and access to the lavatory, to be

lightweight, and easily stored. The resulting Aircraft Wheelchair uses NASA's composite materials and structure analysis technology.

In addition, NASA has just completed an Advanced Wheelchair. The limitations of conventional wheelchairs include heaviness, frequent repairs, and limited lifetime and resulting high life-cycle costs. Wheelchair design, prototype construction, and testing is a costly process. Using improved materials, as well as computer simulation and analysis, should result in a more durable, lightweight wheelchair. NASA and NIHR collaborated with the University of Virginia to use aerospace structure design/analysis techniques and graphite composite materials to develop the advanced wheelchair.

Regulation of body temperature can be impaired by several diseases or injuries including spinal cord injuries and skin disorders. When individuals with these conditions are exposed to even moderately high temperatures, they suffer discomfort and risk hyperventilation, increased heart rate, and heat stroke. In other conditions, such as multiple sclerosis and "burning limb syndrome," cooling the body has been shown to relieve some of the symptoms. A portable cooling garment would eliminate these risks and discomforts, thus opening new employment and daily living opportunities for individuals previously confined to temperature-controlled environments. Technology used in the development of Thermal Control Garments to protect astronauts has been used to make portable cooling systems for transfer to medicine.

Automated foot measurement and shoe manufacturing systems are needed by the U.S. shoe industry. The need for Orthopedic Footwear can result from trauma or diseases such as arthritis, diabetes mellitus, and circulatory disorders. Properly fitted shoes are important to restore function and improve comfort. Neglect of serious foot disorders can lead to disability and amputation. Approximately 9.5 million pairs of orthopedic shoes are manufactured annually in the U.S. The number of artisans available for the manual construction of custom orthopedic shoes is decreasing significantly, creating a growing disproportion between supply and demand. Optical systems technology for 3-D shape digitization and integrated computer-aided engineering and design are being transferred in a NASA, VA, and NIHR project with the U.S. Shoe Corporation.

There are more than 13 million deaf and hearing impaired people in the U.S. Cued speech is a method of improving lipreading intelligibility for the deaf by the speaker's use of finger signals to remove lip shape ambiguities. Manual cued

speech, however, required that the speaker know how to cue speech. A wearable Autocuer Device, using a combination of high speed, low power integrated circuit technology, removes the requirement for the speaker to provide finger signals as cues. A pair of glasses is used for presentation of the signals. With this system, deaf persons or hearing-impaired persons could improve their speech comprehension in a normal work environment. Working with the NIH, National Science Foundation, and VA, NASA is using microcomputer/digital integrated circuits from spacecraft, expertise in computer systems and design verification, along with real-time speech analysis from Gallaudet College, to develop the autocuer. The device is now ready for field evaluation.

In addition to medical applications, NASA's technology has enabled the development of other types of project concepts. Last year, a major project with the State of Maryland's Department of Transportation and a private company, DALMO VICTOR, was completed. The project was to demonstrate Compressed Television Transmission (CTT) for highway traffic surveillance. The technology is derived from the NASA Jet Propulsion Laboratory's data on compressed technology which was developed to transmit TV images from spacecraft over limited bandwidth communications links to Earth. Existing transmission of live TV imagery requires costly, high data rate communications links. Conversely, current slow scan TV operates over low cost phone lines, but frame rates are too slow for effective freeway traffic monitoring. The NASA CTT technology offers a possible solution to improving highway surveillance, safety, and accident rescue.

NASA's Marshall Space Flight Center is assisting the Federal Emergency Management Agency (FEMA) in demonstrating a Firefighter's Training Simulator concept. Using NASA-developed simulation technology, a portable simulator system is being developed by industry, FEMA, and NASA to allow instruction and training to firefighters by stimulating realistic emergency firefighting situations or environments.

For a quarter of a century, NASA has operated at the pinnacle of high technology within the Federal establishment. It could not be otherwise as NASA addresses the enormous challenge of moving people and machines at an increasing pace into a multitude of space missions. The success of these missions, ranging from manned exploration of the moon to servicing orbital satellites, is well known. The advanced technologies developed to support these missions are not as well known but are every bit as impressive. NASA is committed to ensuring that its technological achievements extend beyond the direct needs of space missions to the general benefit of all citizens.

The CHAIRMAN. Thank you. I agree with you, and I want to commend astronauts and scientists like yourself who have contributed so much to the Space Program. We all owe you a debt of gratitude.

I remember how emotional it was for me when Jake's shuttle took off. I realized my partner was going up into space. I did not understand much about that, and I'm not sure he did, either. But it was a tremendous experience for him. He will never forget it, and I do not think he will ever be really satisfied with life until he goes again.

The Senate has become somewhat of a mundane institution in comparison, so we all kind of envy you.

Dr. MUSGRAVE. But probably he has told you, and I will, too, that space is mostly an Earth experience. If you look from space out into space, it is just a black void. There is no light reflected back to your eyes. Space is an Earth experience. It is Earth that gives you the reference point.

The CHAIRMAN. Well, thank you. We will have some questions for you.

Let us turn to Dr. Moser first, and reserve questions for the end.

Dr. MOSER. Thank you, Mr. Chairman.

I am pleased to have the opportunity to discuss aerospace medicine's contributions to improving the care, support, and ability of the handicapped.

In addition to its achievements in maintaining the health of flyers, aerospace medicine has made many significant contributions to other areas of medicine. Today I will consider some aeromedical activities which may be of particular benefit to the chronically disabled. Rather than attempt to describe all the past contributions of aerospace medicine and space technology to the handicapped, I will focus on a few research efforts directed toward enhancing performance which offer the potential for significant advancements in assisting the disabled.

A flyer receives a multitude of simultaneous and often conflicting sensory inputs. The aviator must sort and integrate these inputs, determine the true or real world situation, decide on an appropriate course of action, and then direct his muscles to accomplish the control movements necessary to produce the desired aircraft response.

A finite amount of time, often extending to several seconds, is necessary for these events to occur. Anything that can be done to reduce this time will improve a flyer's effectiveness and safety.

Current studies are designed to achieve just this time reduction. If successful, these programs offer a very real potential for a quantum leap in crew members' capabilities and performance. The technologies developed in pursuing these goals also offer exciting opportunities for enhancing the capabilities of those with mental or physical handicaps.

In the remainder of my discussion, I will consider a few of these efforts to improve performance.

The Neurosciences Laboratory of the U.S. Air Force School of Aerospace Medicine is studying the neurophysiology of sensory and motor systems. The objectives of this program are to delineate the mechanisms involved in processing sensory data and accomplishing desired responses. The underlying hypothesis is that a portion of

the brain, the neocerebellum, modulates or gates sensory and motor impulses by inhibiting and augmenting efforts. The ultimate goal of this work is to facilitate information processing and resultant action.

While of obvious benefit to a pilot, the same research may lead to improved opportunities for a handicapped person to use existing or remaining capabilities and also to develop new skills.

The University of Utah Center for Bioengineering Design developed the artificial arm which is controlled by muscle impulses from other parts of the body. Its ability to duplicate many functions of a normal arm and hand represents a major advance in prosthesis technology. This achievement relies heavily on many space technologies. Of significance to this discussion is the fact that this outstanding accomplishment has, in turn, benefited other aeromedical activities. Thus, the center has provided important information directed toward enhancing motor or muscle function in aviators with normal limb activity. This work may in addition provide opportunities for new benefits for those with abnormal arm or leg function.

Attention and arousal studies are designed to improve data reception and learning ability. These programs offer significant potential for assisting in early rehabilitation efforts and improving existing capabilities in the handicapped individual.

Studies at the University of Illinois use the response from the brain to a visual stimulus to determine, on a real-time basis, whether individuals are actually learning what is being taught. This technique would be of obvious benefit if an individual cannot otherwise communicate progress being made in learning presented material.

At another institution, work is in progress to develop an intelligent tutor system. Unlike its human counterparts, such a tutor is always available any time an individual wants to improve skills or abilities, and it never becomes impatient with repeated errors. This device would be of particular value to an individual with a learning disability who is attempting to develop capabilities necessary to enter the work force.

A joint Harvard-MIT project is designed to develop a system to monitor short-term fluctuations in cardiorespiratory activity. A person appropriately instrumented with this system could be continuously evaluated to determine whether conditioning or other programs were producing desired responses or whether excessive physiological demands were occurring.

At New York University, a small transcutaneous communicator disk is under development to monitor the status of the peripheral nervous system and various biochemical indices. This effort again has potential payoffs for individuals who cannot communicate their status as well as for those with peripheral nerve abnormalities.

Although I have considered only a few activities in one facet of aerospace medicine—that is, improving a flyer's performance—I hope this limited discussion conveys some sense of the diverse and important contributions of aerospace medicine to improving care, support, and abilities of the handicapped.

While it may initially appear there is little relation between a flyer in a high-performance aircraft and a disabled individual, I believe my comments have underscored the significance of aerospace

medicine and complementary aerospace technology, in enhancing the health and capabilities of the handicapped.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Moser follows:]

12/24/85

AEROSPACE MEDICINE'S CONTRIBUTIONS TO
IMPROVING CARE, SUPPORT, AND ABILITIES OF THE HANDICAPPED

Witness Background

I am Royce Moser, Jr., M.D., M.P.H., and am currently Professor of Family and Community Medicine at the University of Utah School of Medicine, Salt Lake City, Utah.

After graduation from medical school and completion of a medical internship, I entered on active duty with the U.S. Air Force in July 1962. I remained on continuous active duty until I retired in August 1985. While in the Air Force, I completed the Air Force Residency in Aerospace Medicine and am certified by the American Board of Preventive Medicine as a specialist in Aerospace Medicine. I am also certified by the American Board of Preventive Medicine in Occupational Medicine and by the American Board of Family Practice.

I was involved in operational, teaching, research, and management aspects of aerospace medicine throughout my Air Force career. During the final two years of that career, I was the Commander of the USAF School of Aerospace Medicine, Brooks AFB, Texas. The School is a 900-member organization devoted to conducting aeromedical clinical, research, and educational activities for the U.S. Air Force, as well as other U.S. and allied flying organizations.

Introduction

In addition to its achievement in maintaining health and enhancing performance of flyers, aerospace medicine has made highly significant contributions to other areas of medicine. Today, I will consider recent and near-term aeromedical activities which may be of particular benefit to the chronically disabled or handicapped. I will not attempt to describe, or even list, all the contributions of aerospace medicine and space technology to improving the status of the handicapped. Publications, such as the National Aeronautics and Space Administration's "Bioengineering and Rehabilitation" (1985) and similar items from the Veterans Administration and other organizations, provide detailed discussions of such technology transfer. Nor will I attempt to consider all the areas of aerospace medicine--such as life support equipment developments, hypoxia studies, and similar activities--which may assist the disabled. Rather, I will focus on selected research efforts directed toward enhancing performance which offer the opportunity for a series of significant advances in assisting the disabled.

As indicated in Figure 1, a flyer receives a multitude of simultaneous, and sometimes conflicting, sensory inputs. The aviator must sort and integrate these inputs, determine the "true" or "real world" situation, decide on an appropriate course of action, and then direct his muscles to accomplish the control movements necessary to produce the desired aircraft response. While these requirements can pose demanding challenges in peacetime environments, the tasks become more complex by several orders of magnitude in a combat setting. A

finite amount of time is necessary for these events to occur, and the amount of time may be several seconds in duration.

Anything that can be done to shorten the time required to assimilate sensory data and take appropriate action will improve a flyer's effectiveness and safety. At the USAF School of Aerospace Medicine, we initiated a series of studies to determine whether it might be possible to enhance data assimilation and integration and also use outputs, or signals, from the nervous and muscle systems to achieve desired aircraft responses. Simultaneously, efforts were underway at other aeromedical laboratories, using different approaches, which were also directed toward improving crewmembers' performance. If successful, these activities will allow shortening or bypassing some of the steps I have discussed. If sufficient time could be saved in aircraft control activities, there would be a very real potential for a quantum leap in crewmembers' capabilities and performance. The technologies and techniques developed in pursuing the goal of improving a flyer's performance also offer exciting opportunities for enhancing the capabilities of others, including those with mental or physical handicaps.

Aerospace Medicine Transfer Opportunities

In the remainder of my discussion, I will consider the following efforts as typical of work designed to enhance crewmembers' capabilities:

Neocerebellum Studies

Prosthesis Developments

Attention and Arousal Investigations

Multiaxis Gyrostatic Sensor System Efforts

Learning Effectiveness Evaluations

Intelligent Tutor Systems

Cardiorespiratory Monitoring Activities

Peripheral Nerve and Biochemical Monitoring Developments

Voice Command Enhancement

The Neurosciences Laboratory of the USAF School of Aerospace Medicine is studying the neurophysiology of sensory and motor systems. As indicated in Figure 2, the objectives of this program are to delineate the mechanisms involved in processing sensory data and accomplishing desired responses. The underlying hypothesis, based on extensive work at many institutions, is that a portion of the brain, the neocerebellum, modulates or "gates" sensory and motor impulses by inhibiting and augmenting efforts. As knowledge is gained of the mechanisms in this system, it is hoped methods will be defined to facilitate information processing and resultant action. For a pilot, this could mean more rapid data interpretation and response to requirements. For a handicapped person, the same research may lead to improved abilities to use existing or remaining capabilities and also to develop new skills. Since this research is basic in nature, it may be several years before it is possible to apply this evolving knowledge. Achievements to date, however, suggest this program has an excellent probability of providing dramatic improvements in individual performance and capabilities.

Committee members may already be familiar with the exceptional capabilities of the artificial arm developed at the University of Utah's Center for Bioengineering Design. This device is controlled by

muscle impulses from other parts of the body, and its ability to duplicate many functions of a normal arm and hand represents a major advance in prosthesis technology. This achievement relies heavily on many space technologies, including electronic miniaturization, composite materials, and body sensor developments. Indeed, scientists in the Center note that costs would have precluded development of the necessary technology if that technology were only to be used for the artificial arm. Of significance in this discussion is the fact that this outstanding achievement has, in turn, benefited other aeromedical activities. Thus, the Center has provided the School of Aerospace Medicine important information directed toward enhancing motor, or muscle, function in aviators with normal limb function. As was the situation with the neurosciences program, this work will also provide opportunities for new benefits for those with abnormal arm or leg function.

Programs are in progress to study both the neurophysiology of attention and the neurophysiology of arousal. The former is directed toward developing improved attention spans, abilities, and similar functions. This effort is not only significant from the standpoint of using available capabilities to detect sensory or other signals, but also with respect to improving learning ability. The latter, arousal, is of importance in determining whether an individual is in an optimum state of arousal, and neither agitated nor drowsy, for a particular activity. Both of these programs offer significant potential for enhancing learning, assisting in early rehabilitation efforts, and improving existing capabilities in a disabled individual.

Work is also underway to develop a multiaxis gyrostatic sensor system which can be used to monitor the motor activities of an aviator in flight. It appears this technology may also be able to assist in teaching simple motor skills using available muscle function capacity. This should be of significant benefit to paralyzed individuals, particularly during initial recovery stages.

A number of other efforts concerned with the neurophysiology of a flyer's sensory and motor systems provide opportunities for significant benefits for the disabled. Thus, studies are being conducted at the University of Illinois which use the response from the brain to a visual stimulus (Visually Evoked Responses) to determine, on a real time basis, whether individuals are actually learning what is being taught. While of benefit in any learning situation, this technique would be of obvious benefit if an individual cannot otherwise communicate progress being made in learning presented material. At Southwest Research Institute, San Antonio, Texas, work is in progress to develop an intelligent tutor system. Unlike its human counterpart, such a tutor is always available anytime an individual wants to improve skills or abilities, and it never becomes impatient with repeated errors. This device would be of particular value to an individual with a learning or similar disability who is attempting to develop abilities necessary to enter the work force.

A joint Harvard-MIT project is designed to develop a system to monitor short-term fluctuations in cardiorespiratory activity. A person appropriately instrumented with this system could be continuously evaluated to determine whether conditioning or other programs were producing desired responses or whether excessive

physiological demands were occurring. At New York University, a small, transcutaneous comunicator disc is under development. This item will be placed under the skin to monitor the status of the peripheral nervous system and various biochemical indices. This effort again has potential payoffs for individuals who cannot communicate their status as well as for those with peripheral nerve abnormalities. Such abilities not only would assist in determining a person's condition, but also would be of very real benefit in evaluating response to rehabilitation efforts. Yet another effort is a planned study designed to make present voice command systems speaker-independent. At present, these systems have to "learn" the speaking characteristics of each person commanding activities through the system. In a clinical setting, this restriction would increase the chance for error and produce time delays. The study will develop a system which is independent of a particular individual's speech characteristics. Such an accomplishment would significantly improve the potential for use of voice command systems in situations involving disabled people.

Additional efforts designed to enhance performance are underway at other government, academic, and private facilities. As previously noted, all the performance studies represent only one portion of current aeromedical thrusts.

Summary

In summary, although I have considered only a few activities in one facet of aerospace medicine, that of improving a flyer's performance, I hope this limited discussion conveys some sense of the diverse and important contributions of aerospace medicine to improving care, support, and abilities of the handicapped. While it may initially appear there is little relation between a flyer in a high-performance aircraft and a disabled individual, I believe my comments have underscored the importance of efforts in aerospace medicine, and complementary aerospace technology, in enhancing the health and capabilities of the handicapped.

The CHAIRMAN. Well, they certainly have.

Let me turn to you first, Dr. Musgrave. I knew that NASA technology was being used to improve the lives of handicapped individuals, but I was also impressed with your testimony concerning the technologies designed to prevent disabilities.

For a long time, I have been one of the champions of preventive medicine, and I believe it is essential that we pay more attention to that end of the research spectrum as well.

Let me just ask you. How long will it be, for instance, before we monitor a person's blood pressure and, say, dispense medicine, based upon that blood pressure when needed, or for instance, monitor a person's blood sugar and dispense insulin as it is needed? How far away are we from those types of technologies?

Dr. MUSGRAVE. I cannot say exactly how far that is to getting it on the street, but on an experimental basis, that is in existence today. There is a device, the programmable implantable medication system, which is directly a result of Secretary Heckler's efforts in the Initiative on Technology and the Disabled.

That is right around the corner, and the technology is there.

The CHAIRMAN. Now, in your personal experience in space research, what experiments do you think have the most potential for helping people with disabilities?

Dr. MUSGRAVE. I think an experiment I ran on my first mission, SDA-6, in April 1983, was an experiment to see that the voice—the voice does change when you go into space—but it was an experiment to see that a computer could still recognize voice commands, and it turned out that it could.

But recognition of voice commands through a computer is incredibly important, I think, to disabled people who do not have hands or feet or other ways of communicating. If they can communicate by voice, they can then have effectors and robotics and everything else and get the job done. So I think that is a very important area.

Bioprocessing, electrophoresis, manufacturing pharmaceuticals in space is another area that I can see coming. There is a great emphasis on the research that is being done toward the space station on robotics and computer-assisted devices. So that might be another way to go.

The CHAIRMAN. I understand that a large part of health-related space research funded by the private sector has been devoted to the development of pharmaceuticals. Could you tell us a little bit about that and what advantages to conducting this type of research in space exist, what type of research in that area has been done to date?

Dr. MUSGRAVE. I ran the electrophoresis of McDonnell Douglas and Johnson & Johnson on my first mission. The advantage to going into space is there is no convection or sedimentation. You can run a medium, a liquid, and it goes, say, from here to there, and put a voltage across it and separate things out in this direction. And they separate only due to charge or mass. If the sample is very heavy, down here on Earth, it is going to fall to the bottom, or you are going to have convection currents that are due to the heating or the voltage you put across it. In space, you do not have any convection and you do not have sedimentation. So the only thing that makes those particles migrate is the voltage and the

charge in the particles. So you get a much more pure separation, as one example.

The CHAIRMAN. That is interesting.

Let me turn to you, Dr. Moser. It is not surprising to me that technology developed to assist our Air Force pilots is also applicable to individuals with disabilities, since both have to function in what really is a hostile environment.

Do you foresee any breakthroughs in this area, or will there be any solutions to the problems—will there be a process of gradual evolution, or will this be a breakthrough-type thing, where are we going in that area?

Dr. MOSER. Well, it is difficult, of course, to predict whether you will have a breakthrough or a gradual evolution. But in my mind, at least, I see continuing progress in the area of neurophysiology, in that what we are trying to do with the pilot, of course, is to bypass some of the steps or shorten some of the steps involved in data assimilation and controlled movements.

In that work, any effort or any accomplishment we make in trying to bypass those steps or shorten the time involved would also be directly applicable, then, to an individual who may have other neurological or physiological problems in accomplishing the end result that he or she may desire.

The CHAIRMAN. I see. Now, the technology you have discussed has the potential of improving lives of not only individuals with disabilities, but really, of all people throughout society.

Dr. MOSER. Absolutely.

The CHAIRMAN. What effect will the new knowledge obtained from the research on attention and arousal which you have discussed have on our efforts to educate both the disabled and the nondisabled?

Dr. MOSER. I think one of the real payoffs from that research will be improved learning ability; in particular, finding out how an individual can best be presented material, and how people can be put in the state of best receiving that material so it will be learned and so they can apply it.

I think the payoff will be the ability to learn material either more rapidly or learn more complex material than would have been the case otherwise.

The CHAIRMAN. I appreciate both of you and your support for Secretary Heckler's initiative. This panel has provided us with important information, as have all of them. Thank you, all.

Let me just say that following the hearing, at 1:30, everyone is invited to attend a symposium on "Technology and the Disabled," in room 628 in the Dirksen Building. There will be a display of some of these innovative devices we have learned of today and an informative film, "Inspire '85," will be shown at regular intervals. I think that would be something all of us would want to see.

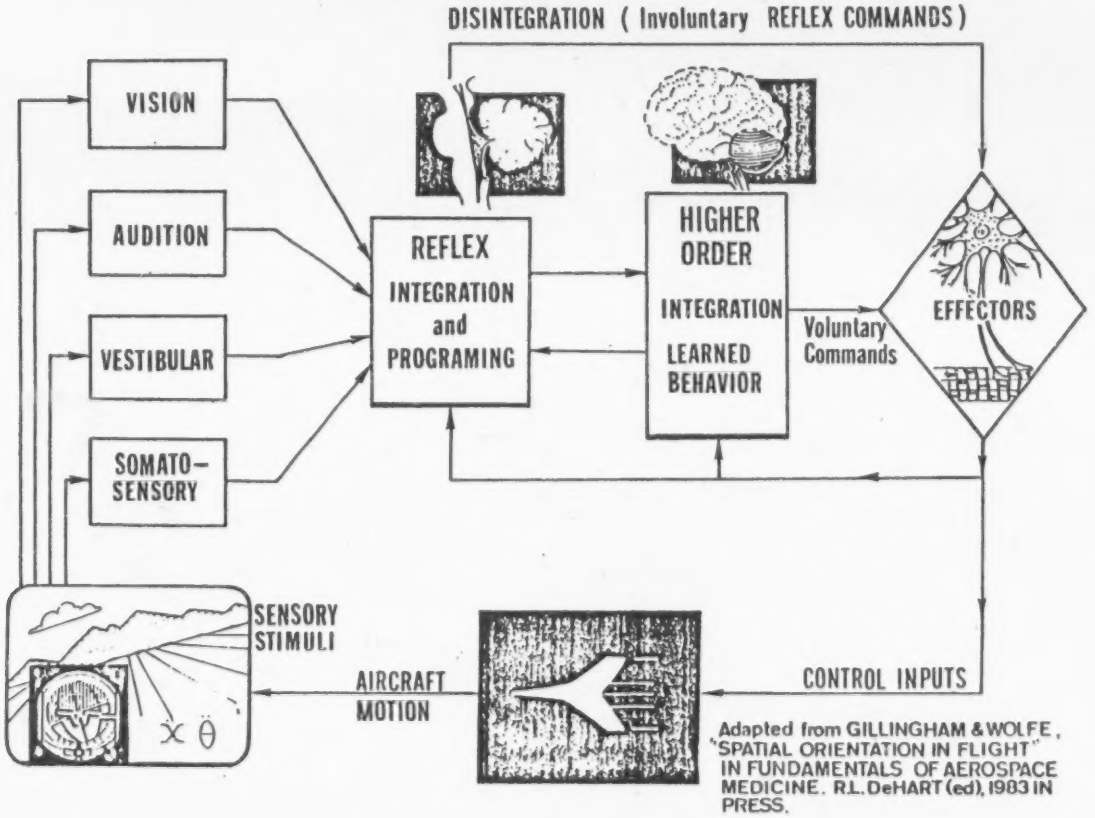
Again, I want to thank you all for being here, and with that, I think we will end this hearing and recess the committee until further notice.

[Whereupon, at 12:35 p.m., the committee was adjourned.]

59-304 (108)

FIGURE 1

FLYING : A MULTISENSORY CHALLENGE



Adapted from GILLINGHAM & WOLFE, "SPATIAL ORIENTATION IN FLIGHT" IN FUNDAMENTALS OF AEROSPACE MEDICINE. R.L. DeHART (ed), 1983 IN PRESS.

FIGURE 2

NEUROPHYSIOLOGY OF SENSORY & MOTOR SYSTEMS

OBJECTIVE

- TO UNDERSTAND BASIC MECHANISMS OF CENTRAL PROCESSING OF MULTISENSORY INPUTS AND THE PROGRAMMING OF MOVEMENTS
- TO UNDERSTAND THE PROCESSES OF HABITUATION, ADAPTATION AND SENSITIZATION IN A MULTISENSORY ENVIRONMENT

HYPOTHESIS

- NEOCEREBELLUM CAN MODULATE, OR GATE, SENSORIMOTOR FUNCTION BY SELECTIVELY INHIBITING AND/OR FACILITATING NEURAL INFORMATION PROCESSING